ILLUMINATING ENGINEER

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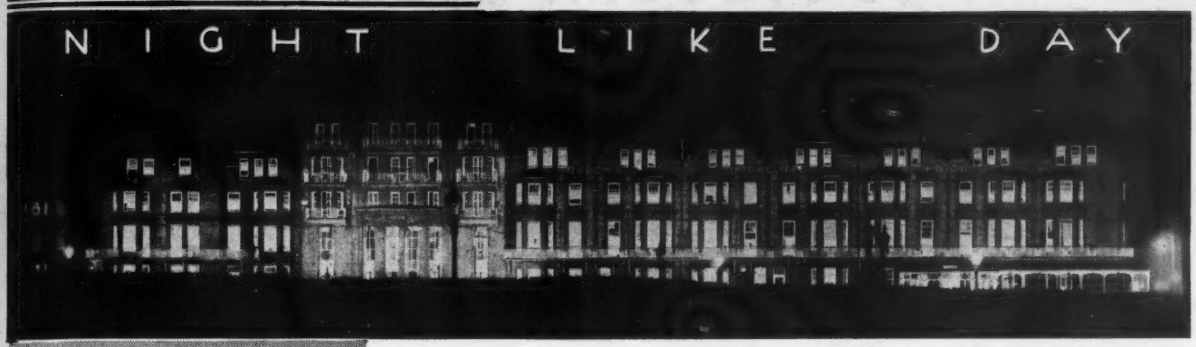

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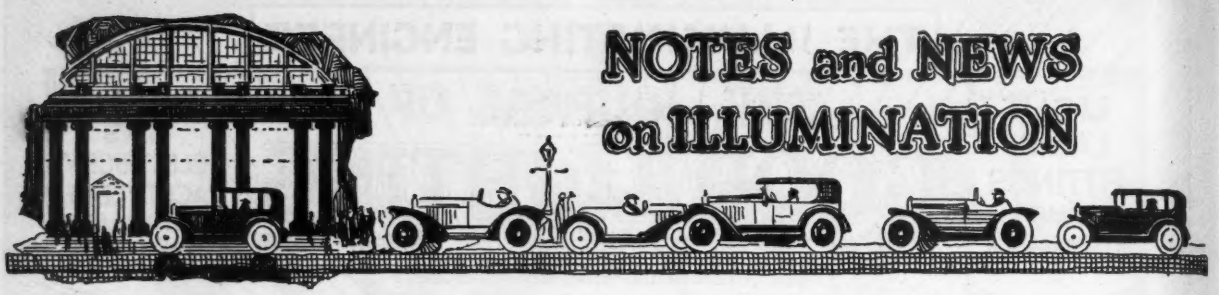
Progress in Illumination

THE Presidential Address delivered by Mr. C. W. Sully before the Illuminating Engineering Society, on October 10th, contained a survey of advances in electric lighting during the past twenty-five years—roughly the period of existence of the Illuminating Engineering Society. This period has seen great improvements in tungsten-filament lamps. It has likewise seen the development on a large scale of gaseous tube lighting, culminating in the hot-cathode lamps which are now exciting so much interest. Here the advance has been equally rapid (notwithstanding the fact, recalled by Mr. Sully, that the Moore tube system was installed in the courtyard of the Savoy Hotel as far back as 1908, even before the Society was inaugurated)—especially in view of the facilities for producing coloured light which this system of lighting affords.

Mr. Sully's address was confined to electric lighting. There have, of course, also been advances in other fields. More momentous than changes in illuminants, however, is the advance in applications of light. In interior lighting generally we have seen first the substitution of overhead general lighting by enclosed diffusing units in place of imperfectly shaded pendant local lamps; next the extending use of indirect and semi-indirect methods, and finally the adoption of extensive surfaces of low luminosity to furnish "architectural lighting." The lighting of tramcars, buses and railway coaches has been enormously improved. Especially striking have been the new methods evolved in such interiors as depend entirely or almost entirely on the use of artificial light. Thus the tube railways have developed a technique of their own, which has not been without influence on the older railway systems, and the cinema palace (a form of entertainment that scarcely existed 25 years ago) has introduced new ideas, both for interior and external lighting, which have reacted on the practices of the theatres. Publicity lighting, in the form of luminous signs, illuminated hoardings and spectacular effects outside places of entertainment, is yet another field that has developed enormously. In pre-war days letter-signs or devices outlined in incandescent lamps were the rule. Now, in combination with luminous tubes, incandescent lamps achieve endless variation in designs of arresting novelty.

All these developments have been accompanied by a radical change in outlook. Twenty-five or thirty years ago, it is no exaggeration to say that the average consumer regarded his lighting as primarily "something on which to save." This almost ineradicable inclination to economy was in part doubtless fostered by the methods of rival systems of lighting at that time, whose appeals were so frequently based on reductions in the lighting bill. Gradually, however, there has grown up, on both sides, a better recognition of the value of good lighting to mankind; so that sellers of light promise better achievement rather than reduction in expenditure, and consumers ask firstly for good performance, and only secondly that it should be secured as inexpensively as possible. In certain cases—large stores, restaurants and picture palaces are instances—it is not too much to say that the consumer now attaches importance mainly to *effect*, and cares little about cost or efficiency provided he secures the desired return in the form of "drawing power." Needless to say, it is in cases where public expenditure is involved (e.g., in streets or schools) that one finds a tendency to lag behind in the general advance. But even in these instances the change in public outlook must ultimately bring about progress.

The display that followed the Presidential Address was surely one of the most interesting yet staged before the Society. The thanks of members are due both to the exhibitors who took so much trouble to display these novelties, and to the E.L.M.A. Lighting Service Bureau, whose facilities for demonstration once more proved so valuable. The display was a very representative one. The new electric discharge lamps were on view, and some highly novel types of fittings and signs were exhibited. The photometric section was on this occasion particularly interesting, and the demonstrations of semi-automatic tracing of polar curves and projected images of heat-currents both received well-merited applause. One was a little sorry that, owing to the generous response to appeals for exhibits, the verbal descriptions were inevitably curtailed; this deficiency we have tried to make good in the full illustrated description that appears elsewhere in this issue. (See pp. 277-292.)



The Illuminating Engineering Society

FORTHCOMING EVENTS.

The NEXT MEETING of the Illuminating Engineering Society is to take place at the Hall of the Institution of Mechanical Engineers (Storey's Gate, St. James's Park, London, S.W. 1), at 6-30 p.m., on TUESDAY, NOVEMBER 14TH, when a paper entitled "THE DEVELOPMENT OF AVIATION LIGHTING," will be read by Major R. H. S. Mealing.

Readers will recall that at the subsequent meeting, on DECEMBER 12TH, Mr. A. W. Beuttell is to read a paper presenting his method of determining the illumination necessary for various purposes, which has been the subject of much investigation by the Technical Committee.

Members are also reminded that on NOVEMBER 28TH a visit (confined to members of the Society) to the NEW BATTERSEA POWER STATION will take place. The party will assemble for the visit at 2-30 p.m. and admission will be by ticket. As the number of the party will, of necessity, be limited, members desiring to take part are advised to inform the Hon. Secretary (Mr. J. S. Dow, 32, Victoria Street, London, S.W.1) as soon as possible and not later than November 18th.

British Standard Specification for Road Traffic Control (Electric) Light Signals

The specification on the above subject recently issued by the British Standards Institution (No. 505, 1933) is the result of a request conveyed by the Departmental Committee on Traffic Signs, which was appointed at the end of 1931. This exceptionally comprehensive specification is divided into six main sections dealing with optical requirements, signal construction, control requirements, controller construction, miscellaneous requirements and tests. Such points as the intensity and distribution of light in the beam, the colorimetric and transmittance qualities of the glass, and the nature of lamps and reflectors are dealt with in detail, and the qualities required from signals in many other respects are analysed—even such possibilities as interference with radio reception are not overlooked. Further information and dimensional sketches appear in the appendices.

Electrical Association for Women

AUTUMN AND WINTER PROGRAMME.

The E. A. W. programme opened on October 2nd with a talk by Miss. C. Haslett on the World Power Conference in Scandinavia. For the remainder of the year numerous lectures and visits have been arranged and instruction and amusement are pleasantly blended. Apart from this regular programme, however, comprising mainly events that take place at 3 p.m., the special lecture-demonstrations and the demonstrators circle fixtures (both of which take place at 7 p.m.) should be mentioned. The former are given partly by experts on special subjects and partly by Miss Dorothy Vaughan; we notice that on November 23rd there is a visit to the E.L.M.A. Lighting Service Bureau when Mr. W. J. Jones will lecture on "Fundamental Principles of Lighting." The demonstrators' circle fixtures are of a very varied character and include an address by Mr. J. H. Parker on "The Wonder of Light and Colour" at which Miss J. B. Kennedy will preside. Fuller information may be obtained from the Director, Miss C. Haslett, C.B.E., at 20, Regent Street, London, S.W.1.

Light Dazzle

Under this heading the *Weekly Scotsman* recently referred to the case of a motorist who, in a Scottish Court, pleaded that he had been dazzled at the moment when the accident occurred. He was told that he ought to have pulled up immediately—unfortunately a difficult thing to do since glare affects the wits as well as vision. Reference is also made to the danger of over-brilliant (i.e. glaring) street lamps such as confuse a motorist approaching from a comparatively dark road. Many motorists who use lights of moderate power, it is contended, find no difficulty on the darkest roads, but at once experience a feeling of uncertainty when they enter the glare of the streets of a town.

American Agitation for Better Lighting

Mr. S. B. Langlands, to whom we are indebted for the cutting referred to above, also draws our attention to a full-page advertisement in an American publication showing how public agitation may influence authorities in favour of better lighting. On one side is reproduced a column from a Boston newspaper summarizing the proceedings at a meeting called to protest against diminutions of street lighting in the interests of economy. On the right hand is a record of the decision of the Council, a month later, to restore full lighting in the city, where every third lamp had previously been extinguished.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Progress in Illumination

(Proceedings at the Opening Meeting of the Illuminating Engineering Society, held at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, at 6-30 p.m., on Tuesday, October 10th, 1933.)

THE Opening Meeting of the Illuminating Engineering Society took place at the E.L.M.A. Lighting Service Bureau on Tuesday, October 10th, when there was an excellent attendance.

In opening the proceedings the Hon. Secretary explained that, to the general regret, Lt.-Commander Haydn T. Harrison had been unable to attend owing to ill-health. He therefore proposed to deal briefly with the introductory business, after which he would make way for the President for the session now commencing, Mr. C. W. Sully.

The minutes of the last meeting having been taken as read, the Hon. Secretary then read out the names of applicants for membership, which were as follows:—

Corporate Members:—

Catten, T. .....Illuminating Engineer, 24, Millbrae Crescent, Landside, Glasgow, S.2.

Gowshall, B. .....Engineer, Gowshall Ltd., Traffic Lighting Engineers, 49, Theobald Road, London, W.C.1.

Henckel-Dawson, Mrs. E., 42, Gray's Inn Road, London, W.C.1.

Henckel, C. E. .....42, Gray's Inn Road, London, W.C.1.

Ireland, E. J. .....Illuminating Engineer, Messrs. Holophane Ltd., Elverton Street, Vincent Square, London, S.W.1.

Toplis, L. G.....Electrical Engineer, 7, Princes Street, Westminster, London, S.W.1.

Country Members:—

Ahmad, R. .....Line Superintendent, Public Works Department, Electricity Branch, Batala, Punjab, India.

Goodell, Paul H. .....Consulting Engineer on Exterior Illumination, 3606-7, Carew Tower, Cincinnati, Ohio, U.S.A.

Siddons-Wilson, A. E., Power and Service Engineer, Messrs. J. S. Fry & Sons Ltd., Union Street, Bristol.

Williams, T. .....Electrical Engineer, Government Electrical Engineer's Office, Mauritius.

The names of those announced at the last meeting of the Society were read again, and these gentlemen were formally declared members of the Society.*

The PRESIDENT, Mr. C. W. SULLY, then took the chair.

PRESENTATION TO MR. J. WYATT IFE.

The President remarked that his first and very pleasant duty was to make a presentation, on behalf of the Council, Officers and Members of the Society, to Mr. J. Wyatt Ife, on his retirement after acting as Honorary Treasurer of the Society ever since its inauguration, twenty-five years ago. (Applause.)

Mr. J. Wyatt Ife, in tendering thanks for this gift, which took the form of a silver rose-bowl, bearing an inscription recording the gratitude of the Society for his long period of useful service, recalled that he had been associated with the Society ever since its inception, and had had much to do with the initial work attending its formation. There were to-day many new faces, not all familiar to him, but still some of the old members linked with those early days. It was most gratifying to him to observe how well the work that he had helped to start was being carried on. For some years past all members of the Council had put in a great deal of work on behalf of the Society. Whatever they had undertaken to do had been done well. Such meetings as the present one dispelled the impression, held by some when the Society was started, that it would be impossible to get the various interests to work amicably together. The Society had provided an impartial platform where those concerned with different methods of lighting could meet together on a friendly footing. He concluded by saying once more how grateful he was for this beautiful present.

AWARD OF LEON GASTER MEMORIAL PREMIUM.

The PRESIDENT then announced that the Council had unanimously decided to award the Leon Gaster Memorial Premium for the past session to Mr. J. W. Ryde and Mr. B. S. Cooper for their contribution entitled "The Theory and Specification of Opal Diffusing Glasses (Part I)," read at the meeting of the Society on December 13th, 1932.

The premium, which was divided equally between the joint authors of the paper, and was accompanied by certificates recording the award, was then presented amidst general applause.

THE REPORT ON PROGRESS.

The HON. SECRETARY then briefly presented the Report on Progress (see pp. 267-271) which had been prepared by the Technical Committee, and was now available in printed form. He remarked that, whilst in the main a record of steady progress in detail, the report referred to several exceptionally interesting developments, some of which were illustrated in the exhibits that evening. The usual practice of marking the advance copies "unrevised proofs" had been followed in order to afford an opportunity for any necessary minor corrections before its appearance in the journal.

* *Illum. Eng.*, June, 1933, p. 141.

The Presidential Address.

Mr. C. W. Sully then proceeded to deliver the Presidential Address, which will be found *in extenso* on pp. 265-267. Mr. Sully remarked that his predecessor (Lt.-Commander Haydn T. Harrison) had dealt with street lighting. He, therefore, had decided to deal only with various phases of interior lighting, and also to confine himself to the system of illumination (electric lighting) with which he was associated. The address consisted mainly of a comparison of present-day conditions with those prevailing 25 years ago—a timely topic in view of the fact that the Society is about to pass the half-way milestone on the way to the celebration of a Jubilee. Reference was made to various papers contributed during the first few years of existence of the Society. At the conclusion of the address a number of lantern slides were shown, illustrating in a graphic and interesting manner the contrast between modern methods of lighting and those prevailing 20 to 25 years ago in the home and in factories, shops and places of entertainment.

Exhibits.

The exhibits proved to be quite as interesting and varied as on similar occasions in the past. Mr. W. J. Jones briefly referred to the newly arranged demonstrations of home lighting, street lighting, etc., at the Bureau, and Dr. S. English showed several new forms of street-lighting glassware for public lighting with gas. Mr. J. W. Lofts showed the latest type of gas floodlighting unit and described its application on the railways.

The new electric discharge lamps formed the subject of demonstrations by Mr. E. L. Damant and Mr. J. Gurney, and their use for colour-effect was further illustrated by Mr. C. R. Bicknell and Mr. K. O. Ackerley. Other new forms of electric lamps were the ultra-violet and architectural tubular types shown by Mr. H. R. Ruff, the photographic flash-bulbs shown by Mr. R. Levenger, and a tubular lamp without end contacts shown by Mr. H. B. Arnold.

Besides the demonstration by Dr. S. English referred to, there were others dealing with public lighting, notably those of Mr. E. L. Damant and Mr. D. A. Hart, whilst Mr. H. H. Long demonstrated a new series of industrial and other lighting units embodying new principles of design. Several novel types of illuminated signs were shown by Mr. Bicknell, Mr. Eldridge and Mr. P. Greenberg.

Not the least interesting were the exhibits showing the operation of new photometers, etc. A new visual photometer was shown by Mr. J. M. Waldram, who also was responsible for an attractive demonstration of the Schlieren apparatus for the detection of heat-streams. Mr. G. H. Wilson showed the operation of a semi-automatic apparatus for plotting polar curves; other apparatus, likewise dependent on the use of photo-electric cells, was shown by Mr. J. Macmanus and Mr. C. W. Leslie.

A cordial vote of thanks to the exhibitors, to the compilers of the Report on Progress, and to the President for his interesting address was moved by Mr. J. S. Dow, who likewise expressed the indebtedness of the Society to the hospitality of the E.L.M.A. Lighting Service Bureau, whose special facilities for demonstration had proved so valuable at these opening meetings.

This vote of thanks having been carried with acclamation, announcements were made in regard to the visit of members of the Society to the Southampton Docks on October 24th, and the next meeting, on November 14th, when Major Mealing's paper on "The Development of Aviation Lighting" would be read.

(*A full illustrated description of the exhibits shown at this meeting will be found on pp. 277-289.—Ed.*)

A Visit to the New Southampton Docks

About 30 members of the Illuminating Engineering Society took part in a very agreeable and interesting visit to the above Docks on October 24th.

The party assembled at Waterloo in a reserved saloon on the 1-30 train, and on arrival at Southampton West Station, after a comfortable journey, were conveyed by motor-bus to the New Dock Entrance, where they were met by members of the Docks Engineers' Staff. Members were then treated to a short lecture, which took place in a saloon car attached to an engine which was afterwards used to convey the party over the course of the new works and up to the King George V Graving Dock. A general outline of this impressive scheme was illustrated by means of a map placed at the end of the saloon car. The Assistant Engineer described the various methods employed to overcome local difficulties in constructing the main dock wall and in filling in the very large reclaimed area behind the Dock wall. He also gave interesting details of the accommodation provided in the passenger sheds, and concluded with a description of the more important features of the Graving Dock, of the method of closing the dock by means of a steel caisson, and of the 5,000 h.p. pumps necessary for emptying the dock in four hours.

The miniature train then started off, and a fascinating view of work under construction was afforded. It was seen how liquid mud is pumped up by dredgers from the water on one side, forming immense slimy areas on the other, ultimately destined to become solid ground. When the train could go no further visitors descended and made their way on foot over rough and slippery ground to the new dock, which, completely empty of water, was an impressive spectacle.

The party were next conveyed to the South-Western Hotel for tea. Then, after darkness had fallen, they returned to the Electrical Sub-station on the new dock works, where the Docks Electrical Engineer described the arrangements for supplying current for the various lighting and power requirements of the new dock extension. Members were able to obtain some idea of the very satisfactory lighting of the new sheds, only one of which is as yet completed. Very favourable comments were made on the special lighting of the buffet and waiting-rooms, which has been carried out on original and modern lines by the aid of concealed sources round the cornice and mounted under recesses in the ceiling.

A special feature of the lighting at the Quay-side was the arrangement of the fittings with a sharp cut-off in a horizontal line, so that no stray light shall reach the bridge of any of the vessels moored at the Quay. The inspection concluded about 7 p.m., an easy return being made by motor-bus and train, and the general feeling of the party on arriving back at Waterloo was that a visit of exceptional interest had been arranged.

Presidential Address

By C. W. SULLY

(Address delivered at the Opening Meeting of the Illuminating Engineering Society, held at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, at 6-30 p.m., on Tuesday, October 10th, 1933.)

IN presenting this address I wish to thank the members of the Society for the special honour of electing me to preside over its work during the completion of the first quarter of a century of its existence.

This compliment may largely be due to my representing one of the two industries which has taken very definite steps to advance the work of the Society by educational means such as the Lighting Service Bureau we are visiting to-night.

My experience in the art of illumination is chiefly due to my interest in a very small, though important, apparatus for converting into light one of its "raw materials," i.e., electricity. I am therefore confining my remarks to the effect of this Society's work on electrical illumination during the last 25 years. In some instances they will apply equally to illumination by means of the other and older form of illuminant, and I hope you will not criticize what follows, owing to my deductions being based upon the illuminant with which I am most conversant.

When this Society was formed in 1909, I had recently returned to this country after a 12 years' sojourn in South Africa. My return from so "dark" a continent at that time enables me to recall more vividly the lighting practice in this country at that date; and reference to your past transactions has confirmed those memories.

Mr. C. W. SULLY
(President of the Illuminating Engineering Society, 1933-34).

Private House Lighting.

Mr. W. R. Rawlings's paper on "Private House Lighting," presented in 1912, contained many illustrations of rooms using chandeliers and other ornamental fittings of those days; the less-important rooms were then equipped with counterweight or plain drop pendants with small conical shades, and sometimes a handkerchief hanging over the shade to add a little artistic flavour to its otherwise work-a-day appearance. In those days provision for local lighting by means of floor or table standards was seldom considered.

Lighting of Shops.

The lighting of shops internally was usually done by similar means with a dash of the larger "Sunbeam" carbon lamps used by the few who realized there must be some advertising value in applying increased illumination for their patrons. Drop pendants were very common in shop windows (they are still too common in some places), but those who wished to outstrip their neighbours in salesmanship usually applied exterior lighting to their windows by means of arc lamps.

Theatres and Restaurants.

Theatres and restaurants in 1909 made little use of external lighting. One of the few exceptions was the Empire Music Hall. A view of this hall in Leicester Square, taken about 1912-13, shows exterior decoration by strings of incandescent lamps—now usually replaced by luminous tubes or pictorial effects.

The cinema theatre, or picture palace, did not exist in 1909, although its lavish use of external lighting has since influenced the practice of other entertainment buildings.

Schools and Libraries.

In 1911 there were discussions by this Society on the lighting of schools and libraries, when Mr. Dow presented records of illumination in a number of London schools. In some famous schools values of 0.5 foot-candle and even less were found. In libraries 2 foot-candles was not unusual. A committee of this Society recommended, in 1913, 2 foot-candles as a minimum for schools and libraries, but we have recently revised that recommendation and raised the minimum value to 5 foot-candles.

Railways.

When the first Tube Railway was opened away back in 1894, all the newspapers commented on the brilliancy of the lighting, yet, in 1911, when some records of illumination in the Tubes were presented before this Society, the Oval Station was reported to have only 0.35 foot-candle on the platform.

Tube Railways, nevertheless, have already adopted advanced practice in illumination matters, and played a big part in suggesting new lighting methods to the older railways.

The lighting of railway carriages by means of electricity had been introduced before 1909, but the railway companies were very loth to adopt such a radical improvement, and their bookstalls were still doing a good trade in the sale of candles to passengers, and also in rubber gadgets, which acted as wall brackets for the candles and adhered to the windows by means of suction.

Mr. Cunnington's paper in 1919 informs us that the colza lamp, as used about 25 years ago, provided only 0.1 foot-candle in certain carriages, whereas the use of electricity had raised the illumination to 1.5 foot-candles.

Street Lighting.

Public street lighting need not be referred to by me, as my predecessor, in his inaugural address, gave you a well-reasoned review of that subject.

I could deal with other applications in a similar manner, but time does not permit.

In those days architects were not "light conscious," and the study of illumination did not form part of the curriculum at their schools, and when the architect dealt with artificial illumination his usual practice was confined to specifying the number or position of lighting points.

The development of electric lighting was mainly in the hands of trained engineers, and efficiency was interpreted as being the use of the minimum amount of light for the purpose in view, and "to save electric light" was a frequent admonition.

The carbon and arc lamps available at that time required the use of a considerable amount of electricity, so that economy became the ruling obsession

and people's minds were scarcely free to consider how light could best be used.

In the year 1909 a well-known engineer asserted that with 5 foot-candles we can read as fast as in daylight, and that for general illumination we only require 0.7 to 1 foot-candle.

The recommendation for shops in the same year was that the candle-power of the lamps employed should be assessed on the following allowances:—

For counters: 4 to 7 candle-power per sq. yd.

For stores: 3 to 3.5 candle-power per sq. yd.

For offices: 5 to 6 candle-power per sq. yd.

and it is distressing to note that a similar out-of-date specification still exists for the lighting of lunatic asylums.

There were, however, some engineers who had already studied the science of illumination, and our thanks are due to them for the formation of this Society.

Speaking generally, progress has been steadily made throughout the last 25 years, and more particularly since the war, but this does not apply in all directions. For instance, it is almost 25 years to a day since the court of the Savoy Hotel was lighted by means of Moore's gaseous discharge tubes, yet we are only to-day experimenting with the use of somewhat similar tubes for street-lighting purposes.

Aeroplanes were practically unknown when this Society was formed. To-day there are 500 licensed aeroplanes in this country which, when equipped for night flying, require on the average 600 lumens per plane.

Exterior Lighting.

Exterior lighting of buildings is rapidly coming to the fore. During the coronation of King George in 1911 there was much spectacular lighting of buildings in the West End of London, almost invariably in the form of designs outlined by incandescent lamps. An installation of decoration by means of concealed lighting was employed on that occasion at White's Club, and was then considered remarkable because of the skill exercised in concealing the lamps.

Floodlighting is mainly a post-war development. At the British Empire Exhibition in 1925 effective decorative lighting was introduced to the public for the first time on a large scale. During the International Illumination Congress in 1931 floodlighting demonstrations attracted large crowds in various parts of the country, and this method of lighting took firm hold of the public imagination.

Edinburgh Castle, which was floodlighted temporarily in 1931, was, in May, 1932, supplied with a permanent installation, which has since been used on various special occasions during some forty nights in all.

Our newspapers are continually making reference to the floodlighting of buildings of historic importance, and it is particularly gratifying to learn that there is a movement on foot to-day to floodlight some of the principal historic buildings in London.

These larger installations should not obscure the fact that there are now thousands of smaller floodlighting installations throughout the country, while the industrial applications of this branch of illumination are in process of rapid development.

To-day you cannot travel through the country at night by rail or road without having your attention attracted to numerous buildings of commercial or other interest by means of exterior floodlighting.

Another feature of this development is the floodlighting of gardens which was recently referred to, pictorially as well as editorially, in the *Times* on September 2nd last.

Other new uses for illumination by means of electricity have been developed, including the lighting equipment of motor-cars. They are utilizing to-day, in this country, at least 1,000 million lumens, which is equivalent to the amount of light used in 300,000 artisan homes.

Regarding modern practice in general, I do not propose to deal with this in detail, as the numerous papers presented to this Society from time to time have enabled members to be fully informed on such matters, and all "who have eyes to see" must be well acquainted with the more intensive lighting of modern shops, the more effective lighting of the modern home, the recent artificial illumination of our sports grounds, and the great strides made in the effective use of coloured lighting.

I shall, however, be showing you, in a few minutes, some slides which are arranged to indicate quickly and clearly the relative applications of old and modern methods to various types of buildings.

Throughout the existence of this Society the work of the illuminating engineer has been materially affected, as well as assisted, by the development of the electric lamp.

First he had only carbon and arc lamps at his disposal. Twenty-five years ago these were followed by metal-filament lamps, then in turn by the large gasfilled lamp, the more normal gasfilled lamp, the high-voltage neon tubes, and now the low-voltage gaseous tube.

Variations in the arrangement of the lighting source always demand modified methods regarding the housing and application of the light obtained, and I am satisfied such variations are likely to continue in the future. For instance, at the present time, lamp manufacturers are developing a more efficient gasfilled lamp which may alter some of the characteristics that have to be considered by the illuminating engineer.

It is now recognized that engineering *efficiency* should not rank higher than *effectiveness;* that "Fitness for purpose" should be as much the aim of this Society as of that young and energetic body called the "Design and Industries Association."

To-day we find the "point sources" of illumination greatly multiplied, their noticeability greatly decreased, and the tendency of the future is to obtain the required illumination from flooded areas of light, rather than from patches of concentrated light.

In other words, the artificial lighting of interiors will follow the modern practice regarding daylight illumination which adopts large areas of subdued light—such as "northern lights for factories"—rather than admitting through comparatively small windows the direct rays of the sun.

There is at present no finality in the art of illumination, and it will continue to be encouraged by our transactions and organization. Our proceedings during recent years have been published in the *Illuminating Engineer,* a monthly paper, ably edited by our Hon. Secretary, which is available to all who are interested in lighting matters.

Modern illumination suffers from the unavoidable lag between the *production* and *adoption* of modern methods. This must be obvious to all, and I have already referred to it when drawing your attention to an existing specification for the lighting of lunatic asylums.

The September issue of the *Illuminating Engineer* contained an article on the lighting conditions of basic industries in Sheffield which also accentuates this point. It contains a table giving particulars regarding the types of electric lighting used in 24 cutlery factories, and it will be noted that only three of these 24 factories are reasonably illuminated.

On the question of glare, the same article contains a table indicating the comparative glare severity in the factories examined, and shows on the average the following results:—

8 per cent. have very bad glare.
Another 21 per cent. have bad glare.
,, 49 per cent. have some glare.

Whereas only 22 per cent. are free from glare.

When dealing with the factors which have hindered improvement in these works at Sheffield, the article states:—

"Local lighting contractors unacquainted with recent progress in industrial illumination are frequently to blame. A common fault is the installation of unsuitable fittings."

This indicates the principal drawback experienced to-day in the application of modern illumination design.

The responsibility for effectively lighting the homes, factories, etc., of Great Britain is shared by consulting illuminating engineers, architects, builders, contractors, etc., according to the importance of the building or the pocket of the customer. Indeed, every shop which sells fittings influences the application of illumination matters in this country.

It is therefore not surprising that so tremendous a lag exists to-day between the production and adoption of illumination as propounded by this Society.

I fully agree with Sir Francis Goodenough when he affirmed that this Society cannot consist entirely of "professional experts."

We have never lacked enthusiastic supporters and able investigators amongst our members, but the need of the future requires the translation of lighting knowledge into practice.

Our membership to-day does not embrace all who have partaken in that development, and has only touched the fringe of those who, in their daily work, are responsible for advising the general public in the use—*the efficient use*—of illumination.

The Society should continue to encourage the younger generation to take an active part in its affairs. The importance of this has already been recognized by our Council when offering each year a prize for the presentation of papers by its younger members as a memorial to its founder, Leon Gaster.

I also hope, at this milestone of our existence, the Society will take definite steps towards forming provincial branches, thus broadening our sphere of influence and adding to the membership many who are eminently fitted to develop its work and ideals throughout this country.

We were indeed fortunate in that our first President was an artist as well as an engineer (Silvanus Thompson was a painter and designer of no mean order). Both attributes are necessary in those who wish to serve the public adequately with those lighting principles which this Society has played a foremost part in formulating.

Progress in Illumination

(Report prepared by the Technical Committee of the Illuminating Engineering Society: Mr. A. W. Beuttell (Chairman), Mr. H. Buckley, Mr. J. S. Dow, Dr. S. English, Lieut.-Commander Haydn T. Harrison, Mr. W. J. Jones, Mr. C. A. Masterman, Mr. William Millner, Mr. Howard Robertson, Mr. J. C. Walker, Mr. H. C. Wheat. Co-opted: Mr. J. G. Clark, Mr. T. E. Ritchie, Dr. J. W. T. Walsh and Mr. G. H. Wilson.)

THE report has been confined to papers and events during the year ending August 31st, 1933, and is devoted mainly to progress in Great Britain. As usual, there is continuous improvement in detail to be recorded, and during the past year there have been several noteworthy advances, notably in connection with illuminants based on the luminescence of gases and metallic vapours. The somewhat more confident feeling that has developed in industry has been favourable to developments in the applications of artificial light.

Gas Lighting.

The past year has been marked by improvements in gas-lighting units, more particularly for exterior illumination, as, for instance, street lighting, shop lighting and floodlighting. Gas for floodlighting has been applied successfully to a number of distinct purposes. It has been used for the illumination of sports and recreation grounds, including swimming-pools, and of architecture and gardens; also in connection with the transport industries, rail and road. It is worthy of note that, from the practical point of view, floodlighting by gas originated from the displays arranged in London and other places on the occasion of the International Illumination Congress of 1931, and may be regarded as an illustration of the stimulating influence of these Congresses. It seems certain that as the existing industrial depression disappears the use of floodlighting will become more and more popular.

Directive lighting by gas, including floodlighting, owes some of its development largely to the successful application of special glass having both good optical and good refractory properties. The importance of mechanical details as a means of ensuring accurate positioning of reflecting devices has been recognized, and good progress in this direction has been made.

Further progress has been achieved in the design of new gas-lighting units for use outside shops—the design and finish being such as to harmonize with modern ideas regarding appearance. Some studies have been made of the factors which contribute to the depreciation of gas lighting with a view to ascertaining how a high standard of maintenance can be assured with the least expense.

Clockwork control of gas lamps has been improved, particularly in the direction of reducing gas consumption by avoiding the use of a by-pass, except for a few moments at the time of lighting.

Progress has also been made in fittings for interior lighting. A special tube for supplying gas to table fittings, together with improvements in the manufacture of the fittings, have resulted in good appliances of this kind being produced at a low price.

Switch control of gas-lighting units for interior illumination has been still further developed.

Some preliminary steps have been taken towards the standardization of certain parts of gas-lighting equipment, more particularly with regard to gas mantles, and further work towards this end is in hand.

It is worthy of note, finally, that technical information regarding gas-lighting units is becoming more and more available to lighting engineers.

Electric Incandescent Lamps.

General Lighting Service Lamps.

The main development in standard incandescent lamps during the year has been in the direction of

obtaining a more consistent product, as a result of general improvements in all operations in the lamp factory. Thus, a more exact control is exercised on the purification of the gas and on the percentages and pressures of argon and nitrogen present in the lamps. As a result, early lamp failures have been materially reduced, while the average lumen maintenance throughout life is from 93 to 95 per cent. This greater consistency of products facilitates group replacements of lamps for street lighting and large industrial and commercial installations.

Two new British Standard Specifications have been issued dealing respectively with Electric Lamps for Railway Signalling (No. 469, 1932) and with Navigation Lamps and Road Traffic Control Light Signal Lamps (Addendum to the B.S.S. British Standard Specification for Tungsten Lamps, No. 161, 1932).

Tubular Lamps.

This year has seen the introduction of a new form of tubular lamp, known as the architectural tubular lamp. By butting the ends of these lamps together it is possible to form a continuous line of light of uniform brightness. The lamps may be straight or curved, with clear, frosted, or any of the following colour-sprayed finishes: red, green, blue, yellow, orange, or flame. They are all available in 30-watt, 40-watt and 60-watt sizes for standard voltages.

Internally Colour-sprayed Lamps.

In addition to the 15-watt sign lamps that were first treated in this manner, 40-watt lamps are now available. These are used not only for outside installations, but for interior coloured or tinted lighting.

In the case of certain forms of lamps intended for series burning in connection with signs a current by-pass comes into operation if the filament burns out, automatically bringing into the circuit a resistance, which prevents overloading of the remaining lamps.

Electric Discharge Lamps.

There is important progress to record in connection with electric discharge lamps. The high-voltage tube commonly employed for sign work has now been employed for decorative lighting. By means of a series of coloured tubes arranged in a cornice, it has been possible to obtain various colour mixtures at will and a complete installation is now in operation at a London store. Various schemes employing "sunlight" tubing have been erected during the past year and are now in successful use.

The most important developments have, however, been in connection with the hot-cathode discharge lamps. In the last progress report, a brief mention was made of lamps which had been developed to run off the ordinary supply mains and which gave three to four times as much light for a given energy consumption as the corresponding filament lamps.

During the past year the development of these lamps has brought them to a very practical stage, and installations incorporating the lamps have been erected and are in operation. For floodlighting and similar applications where large quantities of coloured light are required, tubular lamps having a luminous column about 34 ins. long are now available. These lamps will operate directly off alternating-current mains of standard voltage and frequency, with a choke coil in series and a filament transformer to provide a supply for the hot cathodes. The colours obtainable are red, blue, and two shades of green, and the efficiency of light production is twice to four times that of the usual combination of gas-filled filament lamp and colour filter.

The sodium vapour lamp has been applied to public lighting and one installation employing lamps consuming just under 100 watts has been described in the *Illuminating Engineer*[1]. The light emitted is nearly monochromatic but the efficiency of light production is very high. The output has been given as 5,000 to 6,000 lumens. Special vitreous-enamelled reflectors were designed for use with the lamps to produce a low cut-off and thus a glare-free installation.

The high-pressure mercury-vapour lamp has also been applied to public lighting and a full description has been given in the journal[2]. One of the chief features is the simplicity of connection. The only auxiliary is a choke coil which is connected in series with the lamp on A.C. mains. A condenser may be used if desired to bring the power factor up to a value of 0.83 or over. The first size of lamp to be constructed has a consumption of 400 watts whilst the loss in well-designed auxiliaries (choke and condenser) is 20 watts. The initial efficiency of the lamp has been given as 40 lumens per watt.

The source of light is a luminous column about 6 ins. long and $\frac{1}{4}$ in. in diameter and special fittings have been designed to operate efficiently with it. Reflectors and refractors have been used to control the light in the new fittings and the lamp has also been used in many existing units.

Colour mixture has been employed successfully in one installation, three 200-watt filament lamps being used in diffusing fittings with one 400-watt discharge lamp. The resulting colour of the light in the installation gives an impression of daylight.

Lighting Accesories and Equipment.

Steady progress seems to have been mainly confined to the development and improvement of accessories and equipment that can no longer be regarded as entirely new.

Glassware.

Manufacturers of illuminating glassware have introduced new types, including high-efficiency enclosing units and composite fittings of a more ornamental type, but attention seems to have been focused on improving the quality. Among the new fittings there are naturally a number designed to accommodate the new tubular filament lamps; in these the glass is generally of a more or less ornamental nature. Opal glass globes have been combined with shallow reflectors to form glareless units approaching open reflectors in type. Globes and bowls made of semi-fused silica (vitreosil) of much larger size and in distinctly more attractive shapes than were formerly obtainable have been introduced. Some of these globes and bowls are delicately tinted. A development of importance is the production of British flashed-opal tinted glass in sheet form.

Although not a new lighting accessory, silvered-glass shop-window reflectors are now being made in this country of a quality equal to or better than any that were formerly imported.

Street-lighting Equipment.

Fittings for street lighting have naturally shown most progress in connection with the new types of discharge lamps; these have varied from deep-enamelled iron reflectors to built-up lanterns embodying prismatic glass panels. For use with the ordinary filament lamps a new type of two-piece prismatic dome refractor has been introduced. In the non-axial asymmetric type of these new re-

[1] *Illum. Eng.*, 26, p. 13, Jan., 1933.

[2] *Illum. Eng.*, 26, p. 103, April, 1933.

fractors a reflecting segment is embodied throwing light directly across the road.

Specifications and Reports.

A specification dealing with fittings for double-capped tubular lamps (B.S.S. No. 495/1933) was issued in June last. The revised specification of the B.S.I. concerned with diffusing glass is approaching conclusion.

Interior Lighting.

Domestic and Commercial.

Methods of illumination for utilitarian as well as for decorative purposes have been further simplified as a result of elimination of unnecessary decorative detail from architectural form. A contemporary style of lighting fittings of clean design whose æsthetic value is achieved by satisfactory form and line is developing. A feature of progress has been the wider use, for buildings of all types, of designs and shapes formed of flashed-opal glass with galleries or suspensions free from dust-collecting excrescences and planes. The white-flashed opal glass gives maximum diffusion at the same time shielding the bright filament of the lamp. The tubular fitting has gained in popularity, and is now in common use in all parts of the country.

The present demand in the home, the office, or the hospital is for clean, unpretentious and useful form. "Fitness for purpose" is regarded as an important basis of selection. The gradual lowering of the cost of current has encouraged greater use of indirect lighting, mainly by methods which have been known for some time past. There has, however, been introduced a new form of lighting from gaseous tube of the neon type with several colours combined to produce a slightly tinted reflected light.

The tendency towards diffusion of light and the use of extensive areas of low luminosity has again been in evidence. A noteworthy example has been the lighting of the Masonic Peace Memorial in London, where indirect lighting has been successfully combined with the transmission of light through translucent glass and where substantially similar effects as regards intensity of illumination, limitation of glare, etc., have been obtained with very varied types of lighting fittings.

Industrial.

The year under review has been marked by no outstanding developments in the lighting of factories and workshops. Whilst progress has been limited mainly to the works of large firms, in the smaller factories an increasing use of pearl lamps is tending to mitigate glare, though this is still far too prevalent. There has been a tendency to make increasing use of enclosed diffusing fittings for industrial purposes, particularly for certain textile processes, printing, and the inspection of polished metal products, and also a tendency to extend the use of daylight-blue lamps for processes other than those in which accurate colour matching is required.

On the other hand, progress has been conspicuous by its absence in many factories where the conditions of lighting lag far behind modern recommended standards of practice. The conditions in Sheffield, for instance, are shown to be poor by the results of an investigation made during the past winter by one of H.M. Inspectors of Factories[3]. Attention is drawn to the very unsatisfactory conditions met with in tenement factories, and to the special methods desirable in certain processes involving close inspection of polished materials, e.g., those used in the cutlery and silverware industries and in the manufacture of safety-razor blades.

The continued interest taken in lighting by the Factory Inspectorate and the advice frequently given to factory occupiers on the improvement and effective maintenance of their lighting installations has, during the year, stimulated progress in a number of cases.

In general, the design of new factories indicates an increasing appreciation of the importance of securing the maximum penetration of daylight.

Public Lighting.

The formation of new streets in housing schemes and of new arterial and by-pass roads has led to a considerable extension of the mileage of roads lighted, which has increased by over 100 miles in 17 towns alone reporting to the Association of Public Lighting Engineers. A net increase of some thousands in the gas and electric public lamps in use in Great Britain has taken place.

Directive street lighting formed the subject of an important paper before the Illuminating Engineering Society by Haydn T. Harrison[4]. The incorporation of "directional" reflectors and refractors in both new and existing lanterns has been a general practice, not only in large towns but in small areas. This is a result of the desire to get the utmost value of illumination on the roadway.

Interest in the lighting of seaside resorts was exhibited at the holding of the 10th Annual Conference for the Association of Public Lighting Engineers in Margate, where a paper on this subject was read. A paper by Mr W. N. C. Clinch reviewed recent progress in the lighting of seaside towns and health resorts. Other informative papers dealt with "Electric Discharge Lamps and their Application to Street Lighting," and with the lighting conditions in the Irish Free State, Paris and Bombay. Other features at the Conference were a description of lighting practice in Margate, and a series of demonstrations of recently introduced types of lamps and public lighting equipment, including several different types of electric discharge lamps and gas lamps (high and low pressure).

Luminous Traffic-Control Equipment.[5]

Throughout the whole country the use of traffic-control signs has made rapid progress since the manually controlled systems at Ludgate Circus and the flexible progressive automatic control in Oxford Street were first installed. A subsequent development has been the introduction of "traffic-actuated control," originally adopted at the junction of Cornhill and Leadenhall Street, and since installed in Trafalgar Square and Piccadilly. Luminous traffic-control in varied forms has now been adopted very widely. In India, South Africa, and other Colonies and Dominions the method is also making headway. A recent development has been the use of pedestrian-actuated signals, of which examples are to be found at Norbury and in Manchester.

As a result of reports issued by the Ministry of Transport the use of illuminated signs for other purposes in connection with traffic is constantly extending. One characteristic development has been the great increase in the number of illuminated guard posts on street refuges. Concealed lighting serves

[3] *Illum. Eng.*, September, 1933.

[4] *Illum. Eng.*, p. 146, June, 1933.

[5] Since the preparation of this report the British Standard Specification for Road Traffic Control (Electric) Light Signals (No. 505, 1933), which was prepared by the British Standards Institution at the request of the Ministry of Transport, has been published.

to render these luminous pillars conspicuous objects.

Railway Lighting.

Experiments are now in progress on one of the lines with high-candle-power projectors mounted at about 50 ft. for the lighting of marshalling sidings.

An instance of the development of electric floodlighting on railways is afforded by the extensive area at the Camden Goods Yard (London), illuminated by about twenty 500-watt projectors, mounted partly on the roofs of the shed and partly on poles 35 to 40 feet high.

Experiments with gas floodlights have been made at the adjacent Camden Locomotive Sheds of the London Midland and Scottish Railway. A luminous output of the order of 2,500 lumens can be obtained with a consumption of 25 cubic feet per hour (500 B.Th.U. gas), and a widely divergent beam has been obtained.

On the Underground Railways electric floodlighting has also been developed. Lighting installations of interest in conjunction with the extension of the Piccadilly Line are as follows:—

At some stations located in semi-rural districts where the stations are situated in comparatively dark localities, spun reinforced concrete standards have been erected, each carrying on a circular frame a number of 500-watt lanterns; these being about 42 ft. above ground, provide a good light on the station buildings and approaches, and also serve as beacons, being visible for long distances.

The red brick elevation of Wood Green Station has been very effectively floodlighted with hot-cathode neon lamps housed in special reflectors and operating on the ordinary lighting circuits at 220 volts.

At Southgate station a concrete and glass tower of circular form, illuminated internally and externally, has been erected on top of the station building, and an illuminated fascia with opal glass front panel has been built into the building, completely encircling it and providing a circular band of light about 95 ft. in diameter.

Lighthouse Illumination.

The most important event of the year as regards lighthouse illumination was the International Lighthouse Conference, held at the Dépôt des Phares, Paris, in July. Inevitably much of the time of the conference was occupied with matters relating to engineering and radio problems, but some important lighting questions were discussed. Special reference should be made to the papers by Born[6] and Van Vloten[7] on lamps, and to the paper by Toulmin-Smith & Green[8] on flashing lights. An important decision by the conference was the acceptance of a figure of 0.2 candle at 1 kilometre[9] as the standard for conspicuity for marine lights on which range tables should be based. This figure is in agreement with that generally accepted for aviation lighting. For various other decisions and resolutions the actual proceedings should be consulted.

[6] "New Incandescent Lamps for Lighthouses." Fritz Born.

[7] "Gasfilled Electric Lamps." Investigation of a new shape of filament for lighthouse lamps. P. van B. van Vloten. Dépôt des Phares, Schéveningue.

[8] "The Fixed Light Equivalent of Flashing Lights." A. K. Toulmin-Smith and H. N. Green. Memo. No. 94, Electrical and Ignition Department, R.A.E., Farnborough.

[9] Approximately equivalent to 0.5 candle at 1 mile.

Illuminated Signs.

Lighting as an advertising medium has increased more rapidly than ever during the past year. By far the largest number of such installations consist of luminous discharge tubes and in the majority of cases neon gas has been used, although so many other colours are available. Simultaneously there has been a very considerable improvement in manufacturing processes so as to bring an element of mass production into use.

There has been a development of small portable signs for interior service. Such units are usually self-contained with transformer and electrodes and are capable of being plugged in to the usual points of supply. One interesting sign of this type consists of a sheet of plate-glass which is sandblasted to the design required, and the tubes recessed into the sandblasting, so following the design. In another type a sheet of plate-glass is surrounded by a neon tube and lit through the edges. Many display stands, some of them novel, have also been made on similar principles, the tube being used as the actual stand for light merchandise. Amongst these also the "ripple" tube developed into a circle of light has been a popular feature. A further interesting type of illumination that has been used for advertising purposes during the year is the tubular filament lamp with a flexible filament support, which enables the tube to be bent and the filament to follow a design. Such tubes are usually made in lengths up to 4 ft. and they have been adapted to the construction of large lettering.

Floodlighting.

The most notable advance during the past year has been in the application of the luminous discharge tube to coloured floodlighting.

The more customary forms of floodlighting have likewise been in evidence during the past year. Among the more conventional types of units recently introduced are to be found some giving two beams, one generally of a concentrated character, and the other of a diffused nature. Floodlighting of gardens has received much attention, but many of the installations are of only a temporary character. During last winter successful experiments were conducted in connection with the playing of football by artificial light, but regular play has not yet been established.

Designers of floodlighting displays for buildings have shown more ingenuity and artistry in the effects produced than was previously the case.

The possibilities of under-water floodlighting have been demonstrated in several installations erected during the past year. The application is mainly to swimming-pools where, if the water is clear and the units are well-designed and placed, attractive effects are produced. Many swimming-pools have been floodlighted by the more stereotyped method during the summer in order to make night bathing possible.

Stage Lighting.

The hot-cathode lamp has been applied to the exterior floodlighting of theatres. At present research is going forward on the dimming of this lamp, and if this is successful there should be use for it in stage lighting, but the hopes of those who see a new instrument for cyclorama lighting are at present unfulfilled in that the colours so far obtainable are far from being monochromatic—and apparently monochromatism can as yet be obtained only at the cost of greatly diminished efficiency.

Experiments with the remote control of stage lighting continue, but although more elaborate control of colour-lighting has been installed in

cinemas, there are no reports of its use in stage-plays or in the theatre. In America it has for some time been the practice in large theatres to place the operator in the orchestra, or even further away in the front-of-house. The reactance type of dimmer has there been used and is now making its appearance in this country, but more consideration must be paid to the power factor before this type of dimmer becomes established.

Lighting Education.

The British National Committee has made an attempt to conserve some of the values of the International Commission by circulating the Cambridge resolutions on lighting education as widely as possible. The replies received indicated a widespread opinion that the Commission's findings were interesting, but that their practical realization demanded more time and financial resource than was at present available.

The Committee itself, in co-operation with the Illuminating Engineering Society, organized a course of lectures at the Regent Street Polytechnic during the early months of 1933. In connection with the course there were visits to East London College, Watson House, the E.L.M.A. Lighting Service Bureau, the Home Office Industrial Museum, the General Electric Company's Research Laboratory and the National Physical Laboratory.

Although the course extended into April the attendance at the lectures was well maintained. No doubt the fact that each of the lectures was delivered by an expert helped to keep up the numbers, although it made continuity more difficult to achieve. Steps have been taken to make the lectures available in permanent form, and it is anticipated that they will be published during the winter.

Interest has been expressed in the possibility of establishing courses on illumination as a permanent feature in the curricula of certain colleges, and preparations are now proceeding.

The now familiar courses on Illumination Design conducted at the E.L.M.A. Lighting Service Bureau have been continued. A new development is the Touring Demonstration Van, by the aid of which lectures in remote parts of the country are now being given. A recent experimental visit to Crewkerne and Axminster is stated to have proved very successful, and other districts in the Western area have since been visited.

Photometry.

A considerable number of papers have been published during the past twelve months dealing with photometry and colorimetry, but no very new developments are to be recorded. Photoelectric and "blocking-layer" cells have received considerable attention, and progress is to be recorded in the greater attention which is being paid to a number of defects attendant on their use.

New photoelectric and visual spectrophotometers have been described, while a description of a telephotometer having applications in ordinary illumination work has appeared[10].

Progress on the proposed primary standard of light was recorded at the meeting of the International Bureau of Weights and Measures in January. The proposed primary standard is the brightness of a black body immersed in platinum at its freezing-point. Results of measurements at the National Physical Laboratory give 59.1 candles per cm.^{2}, compared with 58.9 in America and 58.8 in France.

[10] Evans and Chivers. *Illum. Eng.*, 26, p. 80, 1933.
[11] *B. of S. Jour. of Res.*, 6, p. 721, 1933.
[12] N.P.L. Report for the year 1932 (pp. 140-149).

Characteristic equations giving the relation between lumen output, amperes, watts and lumens per watt have been obtained by Barrow and Mayer[11] for gasfilled lamps over a considerable range of voltages. These equations supplement the similar equations obtained for vacuum lamps by Middlekauff and Skogland in 1915.

Miscellaneous Researches.

In addition to the investigation at the National Physical Laboratory noted above[12], the research on glare effects with white light has been continued, and a photometric pupilometer has been developed which enables the pupil diameter to be determined under various conditions.

In connection with studies on the underlying principles of the scattering of light by opal glass, a microscopical investigation has shown good agreement with the theoretical results published by Ryde and Cooper at the Proceedings of the I.C.I. in 1931. Further research is in progress to complete the study of the correlation between theoretical and practical results.

Work is also in progress in connection with motor-car headlights, particularly to determine whether or not there is any advantage in the use of the colour filters in fog.

The Technical Committee desires to acknowledge assistance derived from the following: Mr. L. E. Buckell, Mr. J. G. Clark, Mr. A. Cunnington, Mr W. S. Every, Dr. W. M. Hampton, Mr. J. Langdon, Capt. W. J. Liberty, Mr. G. J. W. Grieveson, Mr. A. B. Read, Mr. H. C. Ridge, Mr. W. H. Seward, Mr. E. J. Stewart and Mr. H. C. Weston.

Information has also been obtained from "Literature on Lighting," published monthly in *The Illuminating Engineer*, to which those interested may be referred for fuller details of developments.

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. L. J. Collier, Mr. H. M. Cotterill, Mr. J. S. Dow, Mr. J. Eck, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. W. R. Stevens, Mr. J. M. Waldram, Mr. W. C. M. Whittle, and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

(*Continued from Page 255, October, 1933.*)

I.—RADIATION AND GENERAL PHYSICS.

282. Measurement and Evaluation of Ultra-violet Radiation. I.E.S. Sub-committee.

Am. Illum. Eng. Soc., Trans. 28, *pp.* 684-691, *September*, 1933.

An inter-laboratory test of a group of quartz-mercury arc lamps was made to determine the relative usefulness and accuracy of various methods of measuring ultra-violet radiation. The agreement appeared to be satisfactory. G. H. W.

283. Quantitative Measurements in the Total Spectrum of Technical Sources of Radiation. H. Krafft and M. Pirani.

Zeits. f. Techn. Physik, 14, 10, *pp.* 393-411, 1933.

Describes a method for the measurement of the absolute value of emitted radiation. A characteristic of the method is the employment of both the prismatic and filter methods of analysis. In the ultra-violet, visible and near infra-red regions, a photocell is employed: in the far infra-red, a thermocouple.

To determine spectral sensitivities, tungsten-filament lamps were used as black bodies, final reference being made to a Bureau of Standards radiation standard. Some stress is placed upon the importance of the gaseous-discharge lamp. Numerous photographs and diagrams are given. W. R. S.

284. Glass for Protection from Infra-red Radiation. E. H. Hobbie.

Am. Illum. Eng. Soc., Trans., 28, *pp.* 658-664, *September*, 1933.

A special blue-green glass is described which transmits 68 per cent. of the visible light, 51 per cent. of the total solar energy, and only 27 per cent. of the infra-red. Spectral transmission data are given. G. H. W.

285. A Combined Tesla Coil and Vacuum Tube. Charles C. Lawritsen and Richard Crane.

Rev. Sci. Inst., Vol. 4, *No.* 9, *pp.* 497-500, *September*, 1933.

The paper describes an oil immersed high-frequency resonance coil which has been constructed and combined with a vacuum tube in such a way that none of the high-voltage parts are exposed to the air. Potentials up to 750,000 volts have been produced. An improved design is proposed which makes its possible to go to higher voltages before cold emission occurs. F. J. C. B.

286. The Equivalent Circuit of a Blocking-layer Photo-cell. Lawrence A. Wood.

Rev. Sci. Inst., Vol. 4, *No.* 6, *pp.* 434-439, *August*, 1933.

An explanation is given of the mechanism of the action of the cell. F. J. C. B.

III.—SOURCES OF LIGHT.

287. The Osram Sodium Vapour Lamp. M. Reger.

Licht u. Lampe, 22, *No.* 17, *p.* 425, 1933.

A description of the Osram sodium-vapour lamp, giving, in particular, the connection scheme, general construction and polar diagram of a unit suitable for street lighting. E. S. B-S.

288. Types of Outages and Their Lamp-hour Durations. Anon.

El. World, 102, *p.* 115, *July 22nd*, 1933.

Gives a table of statistics on the lamp-hours lost for various reasons by the Chicago Municipal Street-lighting System in 1931. W. C. M. W.

IV.—LIGHTING EQUIPMENT.

289. New Equipment. Anon.

Elect., 111, *p.p.* 371-375, *September, 29th*, 1933.

Photographs of recent developments in interior lighting equipment are given. C. A. M.

290. Standard Industrial and Commercial Shade. Anon.

El. Times, 83, *p.* 396, *September 21st*, 1933.

An account, with photograph and drawings, of the new "Coolicon" reflector. This is a vitreous-enamelled unit designed to replace the B.E.S.A. industrial type reflector. Its chief points are stated to be very good cooling, preventing deterioration of flexibles, and cheapness. W. R. S.

V.—APPLICATIONS OF LIGHT.

291. Light and Architecture. Anon.

Am. Illum. Eng. Soc., Trans., 28, *pp.* 645-650.

Illustrated descriptions of five modern interior lighting installations. G. H. W.

292. Guide to Better Home Lighting. Anon.

El. World, 102, *pp.* 338-339, *September*, 1933.

Numerous suggestions are made for improving domestic lighting, both for those who live in apartments as well as for those who own their homes. W. C. M. W.

293. Heat from Lighting as an Air Conditioning Load. W. Sturrock and J. H. Walker.

El. World, 102, *pp.* 377-379, *September 16th*, 1933.

Discusses the removal of heat from lighting fittings by means of forced ventilation, and states that between 50 per cent. and 90 per cent. of the total energy generated by the lighting system beomes a burden on the air-conditioning system, unless special provision is made to remove the heat from its source. The authors conclude, however, that in general, the cost of special ventilation for this purpose is not justified for the present standards of lighting. W. C. M. W.

294. The Life-preserving Role of Good Street Lighting. R. E. Simpson.

Am. Illum. Eng. Soc., Trans., 28, *pp.* 651-657, *September*, 1933.

The paper gives a general review of the day and night traffic accidents in 227 American cities. A detailed comparison is made between the 1931 and 1932 figures. It is found that in cities where the expenditure on street lighting has been increased the number of accidents has fallen, and vice versa. G. H. W.

295. Street Lighting. Anon.

Elect., 111, *p.* 355, *September 22nd*, 1933; *Elect.*, 111, *pp.* 399 *and* 431, *September 29th*, 1933.

Particulars are given of three new street-lighting installations wherein hot-cathode discharge lamps are employed. The installations are at Manchester, Stockport and Kingsbury. C. A. M.

296. Examples of Progress in Commercial and Street Lighting. Anon.

El. World, 102, *pp.* 334-335, *September 9th*, 1933.

Two pages of photographs showing recent progress in American commercial and street lighting. W. C. M. W.

297. Cost of Municipal Street Lighting in Chicago in 1932. Anon.

El. World, 102, *pp.* 350-351, *September 9th*, 1933.

A table of figures showing details of expenditure on Chicago's street lighting in 1932. W. C. M. W.

298. Good Industrial Lighting Pays. D. Spencer-Johns.

El. Review, Vol. CXIII, p. 412, *September 29th*, 1933.

Stresses the importance of adequate lighting in factories. J. M. W.

299. Fewer Failures Under Photocell-controlled School Lighting. Anon.

Electronics, 6, *p.* 255, *September*, 1933.

A description is given of a two-years' experiment in a Tuscumbia (U.S.A.) school, investigating the effect on school-children of better lighting of classrooms. S. S. B.

300. Lighting Small Stores Holds Lucrative Possibilities. A. L. Powell, J. M. Smith, A. Rodgers.

El. World, 102, *pp.* 340-343, *September 9th*, 1933.

An investigation into the conditions prevailing in 1,000 small stores showed that owing to the present industrial depression, wattages had been reduced, and lighting in general had deteriorated. It is, therefore thought desirable to exploit properly designed equipment together with good lamps of high efficiency. W. C. M. W.

301. Response of Crops to Electric Light. R. B. Withrow.

El. World, 102, *pp.* 411-412, *September 23rd*, 1933.

The results of experiments made to determine the effect of electric lighting on plants are given. It was found that when electric lamp light was applied at night as a supplement to daylight, flower production and earliness in flowering were increased with certain crops. Whilst red light promotes growth, blue light inhibits it, and other colours produce proportionate effects. From figures given, nightly irradiation of flower-bearing plants would appear to be justified economically. W. C. M. W.

302. Sign Survey Shows Basis for Revenue Recovery. H. H. Webb.

El. World, 102, *pp.* 346-347, *September 9th*, 1933.

Figures are given showing the result of an investigation into the possibilities of regaining that part of the electric sign load which had been lost in the last three years. The survey included more than 1,000 signs. W. C. M. W.

303. Analysis of Electricity Supply Tables. Thomas R. Broughton.

El. Times, 83, *p.* 341, *September 14th*, 1933.

An interesting analysis of the various tariffs used by 300 representative supply undertakings. Lighting is shown to be the most popular "flat-rate." W. R. S.

304. A Scheme to Floodlight London. G. B. S. Athoe.

El. Review, Vol. CXIII, p. 413, *September 29th*, 1933.

Discusses a scheme for providing permanent floodlighting installations on some prominent London buildings. J. M. W.

305. Garden Floodlighting. Anon.

El. Review, Vol. CXIII, p. 457, *October 6th*, 1933.

Describes and illustrates the effects obtained by simple means in a private garden at Bushey. J. M. W.

306. Floodlighted Soap Bubbles. L. C. Porter and J. P. Ditchman.

Gen. El. Rev. 36, *pp.* 458-460, *October*, 1933.

Describes an attractive display obtained by floodlighting gasfilled soap bubbles as they rise through the air. Full details of floodlights and the methods of producing the bubbles are given. G. H. W

307. The Blackpool Illuminations. Anon.

El. Times, 83, *p.* 374, *September 21st*, 1933.

The floodlighting display given annually at Blackpool is this year made exceptionally fine by the use of hot-cathode gaseous-discharge floodlights, over 100 being employed. Ordinary high-voltage discharge tube lighting is greatly in evidence, notably in the Town Hall, and large numbers of colour-sprayed tungsten-filament lamps. These colour effects are combined with the usual large number of white floodlights and lamps and the results are said to surpass any previous efforts. The whole display is enhanced by the fact that many of the settings are animated. Photographs are given. W. R. S.

308. Seaside Lighting. W. J. Jones.

El. Review, Vol. CXIII, p. 453, *October 6th*, 1933.

Discusses the advantages of the lighting load from spectacular lighting schemes, particularly to seaside undertakings with a small power load. J. M. W.

309. Lighting in the Radio City Theatres. S. R. McCandless.

Am. Illum. Eng. Soc., Trans., 28, *pp.* 665-683, *September*, 1933.

This paper treats in detail the lighting of the two theatres in Radio City. It describes the procedure of design, showing how the form of the auditoriums was influenced by the design of the lighting, and outlines the features of each lighting problem on the stages, in the auditoriums, lobbies and restrooms. G. H. W.

The Development of Public Lighting in the City of Bombay*

By J. P. BLACKMORE
(Public Lighting Superintendent, Bombay Gas Company)

BOMBAY is a densely populated city, 11½ miles long and from three to four miles wide at its widest point. In this small area of 22 square miles live (not always amicably) 1,161,383 souls, of which there are 789,861 Hindoos, 209,246 Moslems, 80,728 Christians, 57,765 Parsees and 23,783 others; these speak no fewer than 62 different languages or dialects.

There are 216 miles of street lighting in Bombay, of which 140 miles are illuminated by gas, 65 by electricity and 11 by incandescent oil lamps; the total number of lamps used is: Gas, 7,329; electricity, 1,315; incandescent oil, 230; and ordinary kerosene burners, 20. All lamps, lanterns, columns and brackets are the property of the municipality, although supplied and erected by the contractors. The municipality maintain a supervising lighting department, consisting of a sub-engineer and inspectors, whose duty it is to see that the various contractors maintain the lamps according to the terms of the contracts, to investigate complaints, and to check the contractors' bills which are forwarded monthly. The municipality pay the contractors a flat rate per lamp according to size and type, which rate includes gas or electricity consumed, lighting and extinguishing to municipal schedule times, maintenance of glass, mantles, etc., and the annual painting of columns or lamps. The repairs to lanterns and columns, and replacements which are other than fair wear and tear, are carried out by the contractors on orders received from the municipal inspectors and are charged for in a separate monthly bill.

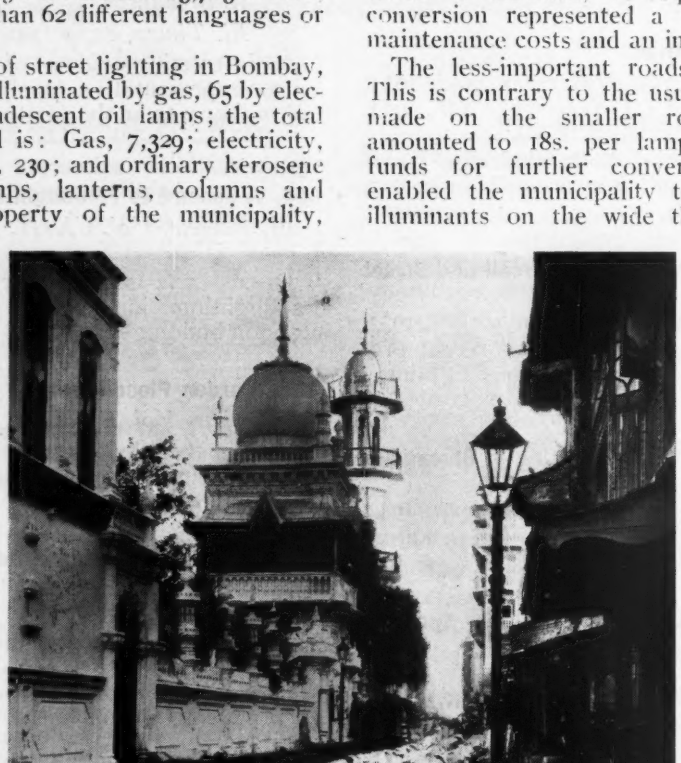


FIG. 1.—A view of a Street in Bombay equipped with 2-light Conversion Burners in Hexagonal Lanterns, mounted on 9-ft. C.I. columns with 3-ft. extension pieces. On the left Mohammedans are seen at Prayers.

A portion of the town was first illuminated by gas with flat-flame burners in 1866; "C" burners were introduced in 1900, inverted burners in 1908 and high-pressure gas in 1911. No progress was made during the war and up to September, 1923. At this date the town was principally illuminated with "C" burners, with a few hundred inverted lamps and about 200 high-pressure lamps.

The "C" burners were fixed in hexagonal-shaped strong copper lanterns, mounted on 9-ft. cast iron columns. The inverted universal size mantle lamps, both one- and two-light, were mounted on swan-necks, from 12 to 15 ft. to the reflector.

In October, 1923, the first two-light No. 2 size mantle superheated burners were fitted to replace the "C" burners. A 3-ft. cast iron extension piece was used to extend the 9-ft. columns to 12 ft. and the height to the mantles 13 ft. 6 ins. The unsightly appearance of the "T"-head type of superheater burner was a disadvantage, but as 80 per cent. of our labour is unskilled, we required simplicity. Each conversion represented a considerable saving in maintenance costs and an increase in candle-power.

The less-important roads were improved first. This is contrary to the usual ideas. The saving made on the smaller roads, however, which amounted to 18s. per lamp per annum, provided funds for further conversions, and ultimately enabled the municipality to erect really modern illuminants on the wide thoroughfares. In the meantime the side roads were better illuminated than many of the important streets. This, however, did not last more than a year or so. Most of the tram routes were provided with 200- and 300-watt electric lamps with prismatic glass equipment, mounted on alternate tram poles. On the other roads gas lamps were erected on 30-ft. steel poles with 7-ft. brackets, and some were centrally suspended. The lanterns and columns thus released have been used on new minor roads or in the re-arrangement of the previously converted lamps, which were 120 to 200 feet apart. The released lamps were inserted to even up the spacing to 120 ft. diagonal.

After the "C" burners were all converted, the old universal mantle lamps were provided with two-light No. 2 size mantle superheater burners in place of each universal mantle. These conversion superheaters were cheap and very efficient. During the first rainy season, the globes, which up to that time had been quite satisfactory, proved to be insufficiently heat-resisting to withstand the additional heat during horizontal rain. This difficulty has been largely overcome by the use of superior heat-resisting glass.

In the next section of the paper the author described typical installations. The two-, three- and four-light conversion burners in hexagonal lanterns, of which there are 4,156, are in general use in the bazaar roads and residential areas, the height to the mantles being 13 ft. 6 ins., and the spacing 120 ft. diagonal. Directive reflectors have been fitted to some hexagonal lanterns. New residential roads up to 40 ft. in width are provided with two- or three-light gas lamps and small swan-necks with 12 ft. C.I. columns.

* Abstract of Paper presented at the Tenth Annual Conference of the Association of Public Lighting Engineers, held in Margate during September 4th-7th, 1933.

The five-light lamp has proved a most useful unit, and it is being erected on roads which would formerly have been provided with 10-, 12-, and even 18-light lamps.

Of the 263 five-light lamps in use, 32 are on "refuge islands," 42 are centrally suspended, and the remainder erected on 30-ft. steel poles with 8-ft. brackets; the height of the reflector is usually 24 ft., and the diagonal spacing varies from 110 ft. to 140 ft. Lady Jamshedji Road, a main road leading out of Bombay, is 80 ft. wide between kerb lines, with two footpaths each 20 ft. wide. It has 86 five-light lamps on 8-ft. brackets spaced 110 ft. from pole to pole diagonally. The road surface is concrete with asphalt covering of a greyish colour. The mid-span illumination is 0.05 foot-candle, and thanks to the height of the lamps, the illumination is evenly distributed and the general impression pleasing. The centrally suspended five-light units are erected 24 ft. 6 ins. high, with a spacing of 125 ft. on a 60-ft. road. The minimum horizontal illumination is 0.025 foot-candle, and 0.035 where stainless-steel wing reflectors have been fitted. These centrally suspended lamps are in continuation of a stretch of similar units, on 7-ft. brackets, at the same distance apart diagonally and at the same height. It is difficult to say which of the two systems give the best results, but generally speaking, the additional capital cost of a centrally suspended system, over lamps erected on brackets and steel columns, is hardly warranted.

Although the five-light lamp is considered the most useful unit, there are no fewer than 395 six-light lamps in use. These burners are in two sections of three mantles each, of which one section is extinguished at midnight. These have been erected on new housing schemes and roads likely to develop. The cluster of mantles in the six-light lamp of two burners is somewhat less compact than that of the five-light unit of one burner; hence the latter are equal to, if not superior to, the former.

There are 47 10-light units in two sections of five mantles each, some centrally suspended at junctions to illuminate the traffic-control police and at heights of 18 to 22 ft.

The first centrally suspended gas lamps were erected in 1924. They are 18-light units, of which 12 lights are extinguished at midnight. The road is 60 ft. wide, the height to the reflectors 20 ft., and the spacing 225 to 230 ft. Most people consider this a fine installation, but the results are somewhat patchy. Furthermore, the heavy lantern makes central suspension a difficult and costly matter.

Bombay's principal sea face, Chowpatty, and the main business thoroughfare, Hornby Road, are illuminated with high-pressure gas lamps. The former has 16 1,500 candle-power column lanterns in three mantles of 500 candle-power each, 25 ft. to the reflectors and 225 ft. between lamps, and the latter 44 1,500 candle-power lamps of three mantles suspended on 8-ft. brackets, height to the reflector 24 ft. and diagonal spacing of 225 and 240 ft. There are also 37 1,000 candle-power high-pressure lamps of two mantles each and 20 500 candle-power lamps, principally erected on the roads leading to the aforementioned sea face. One mantle of the 1,000 candle-power lamps and two of the 1,500 candle-power are extinguished at midnight. The high-pressure lamps have been in use since before the war.

All lighting and extinguishing is done by hand. For the hexagonal lamps a wind-proof torch, manufactured in the gasworks, is inserted in the glass ball trap; a collar on the torch depresses the spiral spring and outer cover, exposing a wick burning coconut oil. The length is so arranged that it is not possible to touch the mantles with the wick or torch. Coconut oil, when pure, burns practically without smoke or soot, so it is easy to discover the lamplighter, who, for purposes of his own adulterates the oil issued to him, from the soot marks on the enamelled steel reflectors. The average number of lamps per lighter is 35, and these have to be lighted and extinguished in twenty minutes (that being the difference in time between sunset and complete darkness). Cluster lamps on brackets up to 18 ft. in height are provided with ordinary lever cocks, and the men use light bamboo sticks and ladders.

FIG. 2.—Queen's Road, Bombay, lighted by 5-light gas lamps with directive reflectors.

FIG. 3.—Gowalia Tank Road, Bombay. Six-light lamps in two sections of three mantles. The uncommon type of bracket is used to avoid telegraph wires. The height to the reflector is 26 ft.

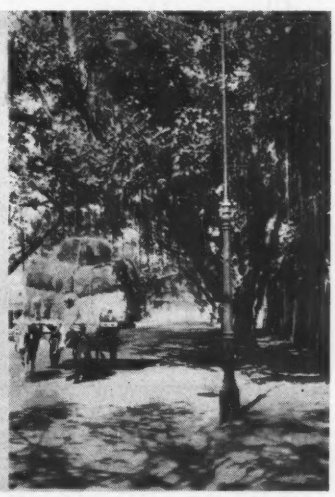


FIG. 4.—Pedder Road, Bombay. Banyan trees, with roots from branch downwards, make conditions difficult. Cast iron columns with extension bracket and 4-light lamps.

Sunset varies from 7.19 in the summer to 6.16 in the winter and sunrise from 5.27 to 6.27, so the shortest night is 10 hours 8 minutes and the longest 12 hours 11 minutes. The lighting hours per annum total 4,051.19 minutes.

The wage of a lamplighter is equal to £2 5s. per month, this being a little above the rate for unskilled labour. The lamplighter's job is to light, extinguish and keep his lamps clean and replace breakages of mantles and globes. Repairs and adjustments are

carried out by men of long experience, who are paid somewhat higher wages. The men are at liberty to clean at times most convenient to them; this is better than restricting them to certain hours and lamps each day, but the men must maintain their lines in good and clean order at all times. During the dry season of approximately nine months, dust accumulates rapidly, and on roads not covered with asphalt a daily dust-over is necessary. The wet or monsoon season lasts three months, during which we have some 80 ins. of rain, which is considerably more than England receives in the whole year. During the monsoon of 1931 we had over 20 ins. in 24 hours. This heavy downpour is usually accompanied by strong wind, and in consequence the rain is driven horizontally, thus striking the globes at the hottest point, which in the ordinary way is protected by the reflectors. Only the very best heat-resisting glass will stand up to these conditions; even so, many globes crack in a straight line, as though cut with a diamond cutter.

However, the monsoon, uncomfortable as it is, is not the lamplighter's most troublesome season, for it is followed by a period of light showers and sunshine, which is marked by plagues of insects. One creature, whose special mission on earth, it would appear, is to break gas mantles, is a very small hard bug, which is able to fly in and out of a mantle several times before passing over to, I hope, a warmer climate. (In one such period six months' stock was issued in two days, but that was an exceptionally bad year and was followed by a year of comparative freedom).

Despite these set-backs, the average life of the No. 2 mantles throughout the year is 3.15 months; the longest life is 4.5 months in the dry season, and the shortest 2.2 during the insect period. "Langlands" two-point fitting No. 2 size mantles only are used for public lighting, and it is not possible for the public to obtain the nozzles or mantles of this type, with the result that when first introduced, some years ago, we saved 30 per cent. mantles from the fact that these were of no use to the tea-shops frequented by the lamplighters.

At the commencement of this paper it was stated that the population of Bombay do not always live amicably. Communal riots occur far too frequently, and are usually the result of some trifling incident. During these times the public lighting is the most difficult, and, at the same time, one of the most important of public services, without which the police and military would be considerably handicapped and the ruffian element encouraged. For these reasons the public lamps are the first to be damaged. The Public Lighting Department of the Bombay Gas Company embodies roughly 40 per cent. Hindoos, 40 per cent. Mohammedans, and 20 per cent. Christians, and as it is not safe at such times for a Hindoo to pass through or even near a Mohammedan locality and vice-versa, the repairing, lighting and extinguishing requires the most careful organization.

Despite the difficulties and danger, the men are brave and loyal, and it is to their credit that so far the public lighting has carried on when most other public services have been at a standstill. During these times the staff are lucky to obtain any rest, for when the day's routine work is completed, complaints of lamps not lit (usually found to be broken beyond immediate repair) and men missing from their homes are received by telephone at all hours and must receive attention.

Very little remains to be said, except that the author will be only too pleased should any member be visiting Bombay to show him the city and the public lighting, of which we feel justly proud.

Electric Discharge Lamps and their Application to Public Lighting

Our attention has been drawn to certain omissions and condensations in the abstract of Mr. G. H. Wilson's paper on the above subject which appeared in our last issue. In order to avoid any possible misunderstanding, we gladly give publicity to the following corrigenda suggested by the author:—

Page 231, *Column* (1), *line* 18.
After "excited" insert "electrically."
Capital letter for "When" as the beginning of a new sentence.

Page 232, *Column* (1), *line* 1.
Delete sentence "With . . . . . colours," and substitute "When suitable red, green and blue gelatines are used with a 300-watt filament lamp running at 14.2 lumens per watt, the combinations of lamp and filter give efficiencies of 2.1, 2.6, and 1.4 lumens per watt.. By comparison the tubes have between two and four times the efficiency of the usual combination of lamp and filter."

Page 234, *Column* (1), *line* 19.
Insert after "5.5 : 1" "and an average diversity of brightness of the road surface ahead of the driver in a line parallel with the curb of only 1.4 : 1."

Line 42.
Delete "thus" and insert "usefully."

Page 234, *Column* (2), *line* 6.
"(1) Observers who are to make measurements on discharge-tube installations should have their Y/B ratios determined by the method suggested by Ives, so as to be able to correct for their colour sensitivity."
"(2) Corrections by this method can only be applied reliably with a photometer of the Guild Flicker type or one having a Lummer-Brodhun contrast head."

Exhibits Illustrating Progress in Illumination

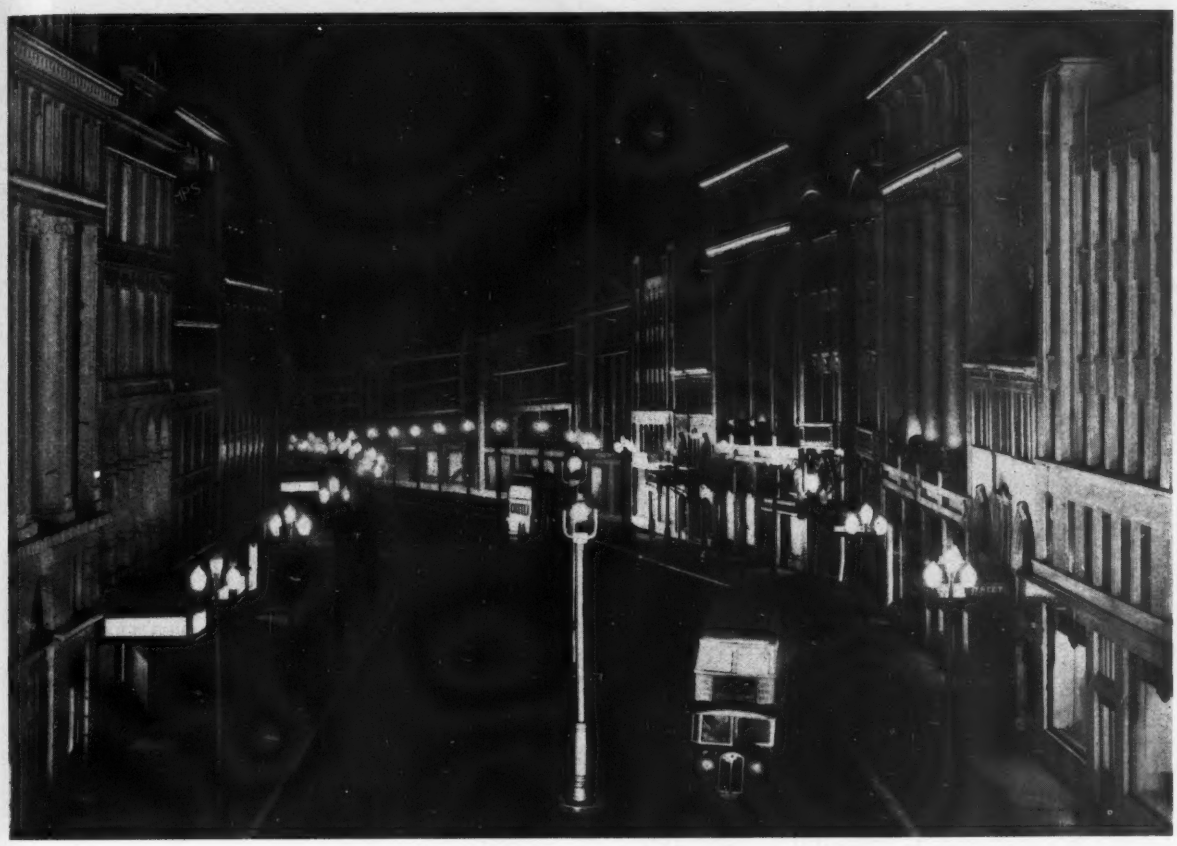


FIG. 1.—A view of the Model Street—only 8 feet long, but with everything made to scale—at the E.L.M.A. Lighting Service Bureau.

THE exhibits at the Opening Meeting of the Illuminating Engineering Society, on October 10th, were even more varied and interesting than in past years. There were 18 speakers on the list, and over 20 separate exhibits, so that each item could only be briefly described.

NEW FEATURES AT THE E.L.M.A. LIGHTING SERVICE BUREAU.

As usual, the meeting was held in the lecture theatre of the E.L.M.A. Lighting Service Bureau, where Mr. W. J. Jones briefly described some new features that have recently been developed. It will be recalled that the premises were reorganized and remodelled last year. The new reception room, with its simple plywood walls, rubber flooring and built-in settee with a luminous electric clock above it, strikes at once a modern note. In the General Demonstration Room, opening out of this, there are numerous attractively staged small exhibits, illustrating the advantages of modern lighting in factory, shop and street. There is an attractive display in the Architectural Lighting Room. The lecture theatre, in which the meeting was held, with its specially designed platform and apsidal recess demonstrating the effect of coloured light on curved forms, is in itself an example of architectural lighting. Reference to these has already been made in this journal. Mr. Jones referred more particularly to the new home lighting demonstration, the displays of signs and floodlighting, and the street-lighting equipment.

In the Home Lighting Department an attempt has been made to concentrate the essential features in the lighting of each room in the home. Elsewhere two banks of floodlighting projectors, all connected to the electric supply, so that any one can be operated at will by merely pressing a switch, throw their beams across the room. The illumination of the exterior of the building every evening affords a practical example of floodlighting. The series of street-lighting units, illustrated in Fig. 2, can likewise be switched on by merely pulling the cords attached to them and forms an exhibit of great interest to public-lighting engineers. To them, also, the ingenious Model Street (Fig. 1) is of exceptional interest. Although the model is only 8 ft. long, everything is made to scale—even the L.C.C. omnibus—and the buildings all have their prototypes in London. Several types of street lamps, typical of the various systems in use, can be wound

FIG. 2.—This row of street lamps can be switched on by merely pulling the cords attached to each. Beneath each fitting is a chart illustrating its main characteristics.

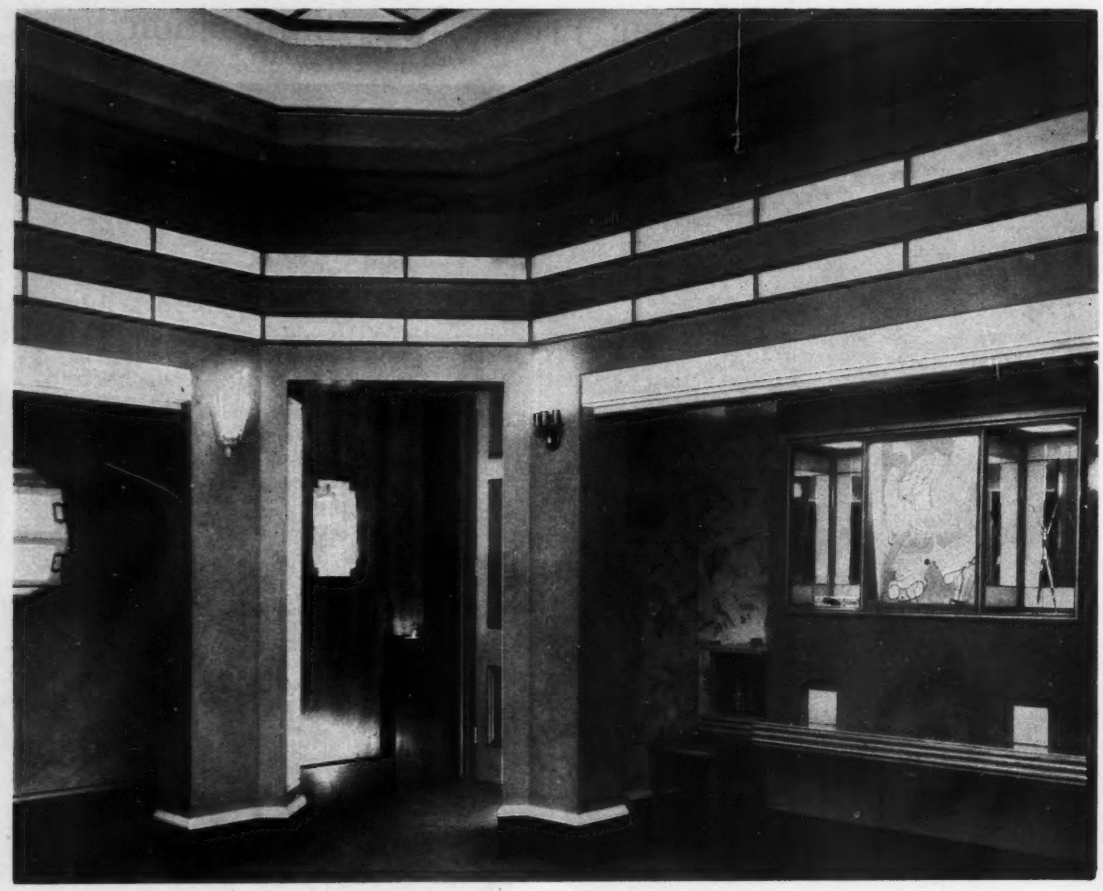


FIG. 3.—A section of the Architectural Lighting Room at the E.L.M.A. Lighting Service Bureau.

up through the surface of the street, and their comparative effects compared.

In dealing with the subsequent technical exhibits it will be most convenient to divide them into seven main groups comprising respectively gas-lighting equipment, electric discharge lamps, other special electric lamps, street-lighting and other fittings, photometry and illuminated signs. In the first section we have the Gas Refracting Dish exhibited by Dr. S. English.

A Refracting Dish for Directional Street Lighting with Gas.

Dr. S. English (Holophane Ltd.), in introducing this exhibit, which is illustrated in Fig. 4, explained that, owing to the particular nature of the light-distribution from a gas street-lighting lamp using a ring or cluster of mantles, a position for the refractor underneath the mantles has distinct advantages. This gas refracting dish has been designed for use in this way, and is made of very high heat-resisting glass. It has been specially made for use with the 5-6-7-cluster burner in pendant lanterns having a $9\frac{3}{4}$ in. diameter (over flange) round type globe. It can equally well be used in square type lanterns.

The prismatic arrangements in the refractor are all embodied on the inner surface of the dish, and are designed to give two broad beams of light at 160° to one another, with a maximum intensity at about 150° below the horizontal.

Besides giving a marked improvement in the intensity of the light at and near this angle, this refractor reduced the diversity ratio considerably, thus enabling gas street-lighting to give results similar to those obtained in the directional electric-lighting street installations.

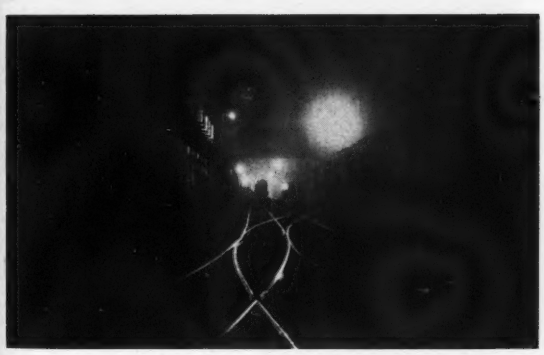
Floodlighting with Gas.

Mr. J. W. Lofts (W. Sugg & Co. Ltd.) next referred to the problem of floodlighting with gas, which at one time appeared to be a rather "tall order." It would be recalled, however, that the problem had been tackled by the Technical Section of the Gas Light and Coke Company at Watson House with great success in connection with the International Illumination Congress (1931), when the gardens in St. James's Park were thus illuminated.

FIG. 4.—Showing the use of the Refracting Dish below the mantles of a typical street lamp.

The form of lamp shown by Mr. Lofts at the meeting, which is illustrated in Fig. 5, is a development of the experimental type used on that occasion.

Mr. Lofts mentioned a recent installation in the L.M.S. Loco. Sheds (illustrated in Figs. 6 and 7) as an interesting example of the versatility of the lamp. In this case the lamp is, of course, mounted overhead so as to project light downwards, and is found to be very effective in indicating the positions of the points, ash-pits, etc. Ten of these lamps were fitted at the Camden Loco Sheds about 18 months ago, and these were fitted with chromium-plated reflectors. Recently, however, one of the lamps has been provided with a reflector of Barnes Process mirror glass. With this reflector an output of 3,500 lumens and a maximum intensity of over 20,000 candles is obtained, whilst with the chromium-plated reflector the value is about 25 per cent. lower. These lamps are fitted with a superheated cluster of ten No. 2 mantles, which remain stationary and independent of the movement of the reflector. A smaller size utilizing only seven No. 2 mantles is also available.



FIGS. 6 and 7.—Night Photographs illustrating floodlighting with gas at the Camden Loco. Sheds.

It was remarked that records of these lamps over a period of twelve months showed that, in spite of the very severe conditions to which they were subjected, the maintenance was quite an economical proposition.

ELECTRIC DISCHARGE LAMPS AND THEIR APPLICATIONS.

We will deal next with several exhibits illustrating the applications of the new electric discharge lamps.

The "Escura" Discharge Lamp.

Mr. L. E. GURNEY (Edison Swan Electric Co. Ltd.) demonstrated the recently introduced "Escura" Discharge Lamp. The lamp was mounted in a fitting, with egg-shaped diffusing globe, intended for general illumination in those positions where no particular control of light-distribution is necessary, and the general appearance of the unit is of some consideration, and absence of glare desirable.

FIG. 5.—Showing the latest form of Sugg's Floodlamp.

The lamp started immediately on switching on, the light passing through various colours in the first few seconds until attaining the characteristic greeny-blue of the mercury discharge lamp, when the intensity commenced to build up to the maximum, which is attained 3-5 minutes after switching on, the operation becoming normal after a further ten minutes, when the lamp is absorbing approximately 400 watts and giving around 16,000 lumens.

The lamp is at present only available in one size, suitable for alternating-current circuits of 230/250 volts, and is operated in series with a choke absorbing approximately 20 watts. A condenser connected in parallel with the lamp and choke is desirable to improve the power factor. The light-output of the lamp is practically equal to that of a 1,000-watt gasfilled filament lamp.

The lamp itself comprises an inner tube of special heat-resisting glass, in which the electrodes are sealed and between which the discharge takes place. This inner tube is contained in an outer tube, the space between the two being evacuated to conserve the heat. The complete lamp is approximately 12 ins. long by $2\frac{1}{2}$ ins. diameter, and is fitted with a standard "Goliath" E.S. Cap, which is used in an ordinary "Goliath" lamp-holder.

FIG. 8.—The "Escura" Discharge Lamp in diffusing globe.

The Edison Swan Electric Company, Ltd. have developed other fittings for use with this lamp to give special light control for street lighting, floodlighting, etc., which, although not demonstrated at the meeting, will shortly be available for those situations where such forms of light-control are

necessary. An illustration is shown of the lantern used at the demonstration (see Fig. 8), and also of a floodlighting installation (Fig. 9) employing these lamps with very striking effect and considerable economy.

"Osira" Street-lighting Lanterns and Equipment.

Mr. E. L. Damant (General Electric Co. Ltd.), who dealt with the above subject, remarked that the *post-mounted refractor lantern* shown was the first to be evolved specially for use with these new lamps.* He drew attention to the following distinctive features: (1) Modern design on entirely fresh lines. (2) A combination of controlled light-

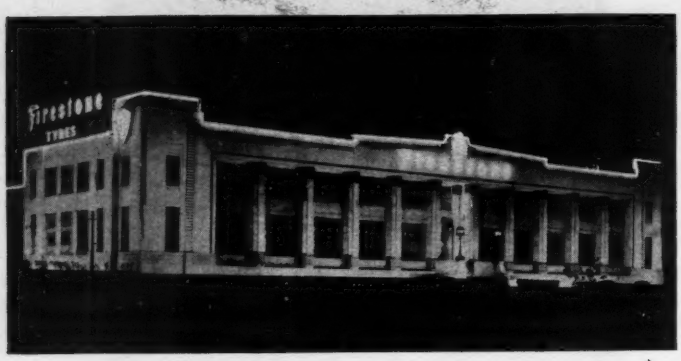


Fig. 9.—Floodlighting of the Firestone Building on the Great West Road by means of "Escura" Lamps in "Saturn" Reflectors.

ing, giving extensive distribution up and down a road with general diffused local lighting. (3) The production of high and even road brightness by the provision of a broad peak in the polar curve in the vertical with no sudden cut-off. (4) Reduction of glare towards oncoming traffic by the reduction of the candle-power in that direction as compared with the reverse direction. (5) Reduction of glare by a special optical arrangement whereby variation of candle-power in the different directions is achieved by a fixed area of varying brightness, instead of by a varying area of fixed high brightness. (6) Durability by the use of non-ferrous metals in the lantern and hot-galvanized wrought iron for the brackets. (7) Special rigid fixing of lantern to post by novel form of supporting bracket and clamps. These also avoid the threading of cables through piping. (8) External connecting-box ready wired to lampholder with special heat-resisting cable to facilitate wiring-up. (9) Non-ventilated construction to reduce maintenance costs. (10) Variable focusing in plan view by sliding lampholder.

The *Bracket-mounted Refractor Lantern*, likewise exhibited, is erected on a projecting bracket, so as to be suitable for broader roads, but embodies similar principles of light-control. Another special *reflector lantern, yielding symmetric distribution*, was shown. This lantern was originally designed for use at special points in an installation using the above lanterns where a symmetric distribution was required, as, for example, at cross-roads. The lower reflector in conjunction with the upper gives a cut-off in the vertical, whilst allowing the full candle-power to operate in the peak direction. A heat-resisting glass cylinder is provided to protect the lamp from driving rain, and an external connecting-box is included to facilitate wiring Special heat-resisting cable is provided between this box and the lampholder.

* "Luminous Discharge Lamps on the Watford Road, Wembley." *Illum. Eng.*, April, 1933, pp. 103-106.

"Osira" Colour Floodlighting Lamps.

Mr. R. O. Ackerley (General Electric Co. Ltd.) was responsible for an exhibit showing a floodlight designed to make practical commercial use of the "Osira" colour floodlighting lamps. The entirely new features of this light-source, which takes the form of a column of light of appreciable diameter, naturally involve the development of new ideas in light-control. This form of light-source, for instance, has obvious limitations when it is desired to obtain a narrow-angle concentrated beam of light, such as results from the use of an incan-

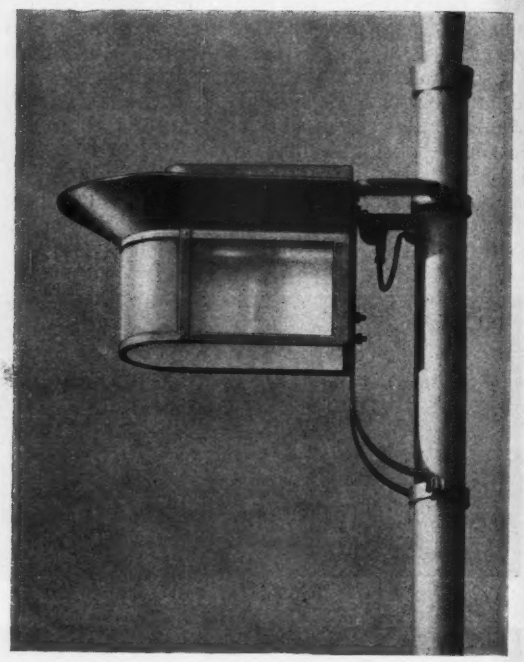


Fig. 10.—Showing the original design of lantern for use with "Osira" Lamp.

descent projector lamp in conjunction with a parabolic reflector, but where it is desired to spread light over a flat surface, as in the case of building faces, or areas of ground, the tubular light-source is peculiarly suitable.

The operation of the "Osira" lamp involves the use of a choke, a small transformer, and a "Tesla" coil, and the body of the floodlight, in addition to housing the mirror-glass reflector specially designed to control light to the best advantage, also holds the two last items of equipment. The choke is supplied as a separate piece of apparatus for installation anywhere between the floodlight unit and the controlling main switch.

The lamps can be supplied for use on any alternating-current supply from 200/260 volts, and the colours at present available are red, blue and two shades of green. The lumen output varies slightly with the different colours, but is in the neighbourhood of eight lumens per watt, being two to three times as efficient as a floodlight of similar wattage employing incandescent lamps and colour screens to obtain a similar colour effect. Furthermore, the colours seem to have a peculiar brilliancy which is unobtainable with ordinary commercial colour mediums and white light sources. While all colours are equally effective on stone and concrete buildings, the red colour is particularly effective on brickwork.

It is stated that over 100 of these floodlights have been supplied to the Blackpool Corporation for use during the annual illuminations in Blackpool, and a number of other installations are in operation throughout the country.

FIG. 11.—Fitting for "Osira" Colour-lighting Lamps.

"Sieray" Colour-lighting Units and Neonic Sign Lamps.

Mr. C. R. BICKNELL (Siemens Electric Lamps and Supplies Ltd.) showed some new colour-lighting units embodying the "Sieray" electric discharge lamp (Fig. 12), to which allusion was made in our last issue. It will be recalled that this lamp consumes approximately 400 watts and furnishes 16,000 lumens. It lends itself very well to colour-effects (as was illustrated by the "primrose" effect on the illuminated dial on the Jubilee Clock Tower at Margate). Mr. Bicknell also demonstrated the recently introduced "Neonic" sign lamps—a new development of the neon-filled lamp suitable for ordinary supply voltages, which may fitly be included in this section. The feature of the device is the use of metal letters which assume a uniform orange-red glow, and are sufficiently bright to "stand out" even in quite strongly illuminated surroundings. The cost of operation of such devices is negligible (a single sign lamp will probably consume only about 1/20th of a unit during a 10-hour day), and they are practically cold in operation. In Figs. 13 and 14 we have views of a single lamp featuring the name "Siemens," and above it a made-up sign suitable for use in a draper's shop.

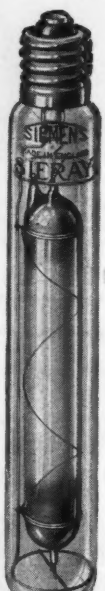


FIG. 12.—The new "Sieray" electric discharge lamp, furnishing 16,000 lumens and consuming 400 watts.

OTHER SPECIAL ELECTRIC LAMPS.

Turning next to several other new types of lamps shown at the meeting, we may mention first that evolved to furnish "Artificial Sunlight," and described by Mr. Ruff.

The "Mazda" Sun-lamp.

Mr. H. R. RUFF (British Thomson-Houston Co. Ltd.), in demonstrating this *ultra-violet lamp*, referred to the movement to give interior lighting properties more closely resembling those of sunlight. Efforts had been made to imitate the colour of daylight, and recently the invisible radiant energy emitted had also been studied and measured and had been found to perform important duties.

In Fig. 15 the distribution of energy in the spectrum of light from the sun, as it reaches the earth, is presented. If we distinguish five bands: (1) short ultra-violet rays, 2,900 A. to 3,130 A.; (2) middle ultra-violet rays, 3,130 A. to 4,000 A.; (3) the visible spectrum, 4,000 A. to 7,000 A.; (4) short-wave infra-red rays, 7,000 A. to 14,000 A.; and (5) long-wavelength infra-red rays, 14,000 A. to 25,000 A., we find that the energy reaching us is distributed in the proportions 0.04 per cent., 3.96 per cent., 40 per cent., 39 per cent. and 17 per cent. in these five regions.

FIGS. 13 and 14.—Showing a simple Neonic Sign Lamp composing the word "Siemens," and above it a complete mounted sign suitable for use in a shop window.

At first sight it might appear that the ultra-violet radiation, forming only 4 per cent. of the whole, is relatively unimportant, but in fact its influence in causing sunburn is well-known. It also has important germicidal and other physiological effects, and forms the basis of treatment of some diseases. The band of radiation designated by "A" in Fig. 16 is radiated by the sun but absorbed in the earth's atmosphere. Generated artificially, such ultra-violet rays are of value for medical treatment, but should not be applied except under medical advice.

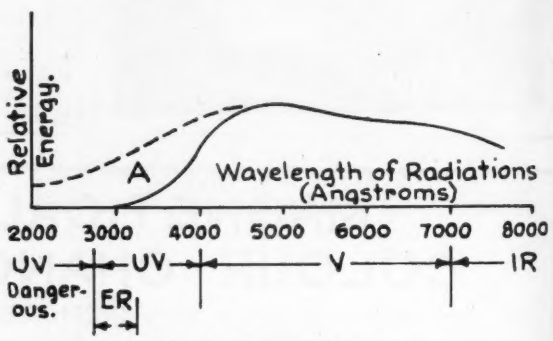


FIG. 15.—Radiation from Sun.

In winter in England the rays that cause sunburn are almost completely absent from sunlight, from which, however, with a luminous intensity of 8,000 foot-candles, an ultra-violet energy-intensity of 40 microwatts per square cm. may, under favourable conditions, be attained. The radiation of the sun is almost identical with that of a body heated to 5,500° K.—a temperature that cannot be reached in electric lamps at present. As, however, so much of the ultra-violet radiation is absorbed by the earth's atmosphere one can obtain an equivalent amount of useful energy radiation from an over-run tungsten filament operating at about 3,000° K., provided the bulb allows this energy to be trans-

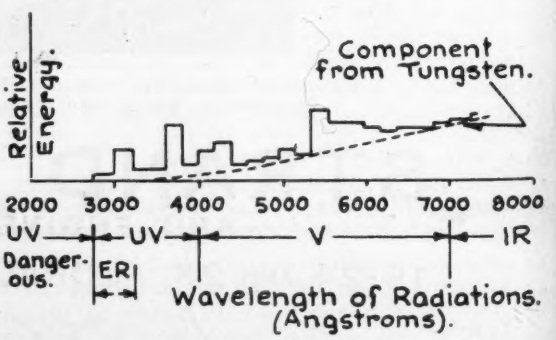


FIG. 16.—Radiation from Sun-lamp.

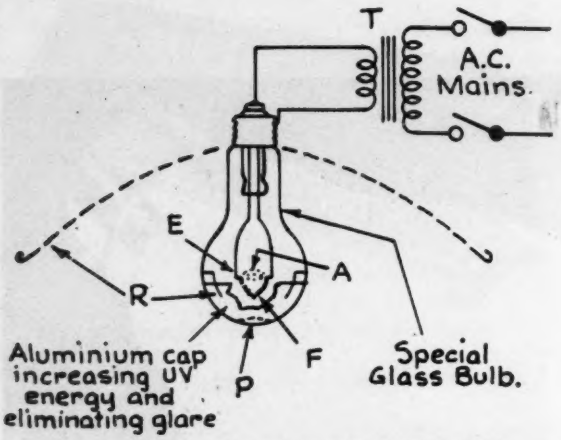


FIG. 17.—Showing details of the "Mazda" Sun-lamp.

mitted. With such a source, however, relatively little ultra-violet radiation of medium wavelength can be obtained.

There is another artificial source of ultra-violet radiation and light which has recently been perfected. This is shown on Fig. 17, and when running it consists of a mercury-arc shown at A operating between two tungsten electrodes E. The lamp is essentially a low-voltage alternating-current lamp, and is operated from a transformer T in which is incorporated the stabilizing reactance. On starting, this transformer supplies the starting filament F with a current of 2 amperes at a voltage of 30 volts; this incandesces, and immediately an arc is struck across the electrodes E. This arc runs with a voltage drop of 15 volts and passes 7.5 amperes, while the starting filament carries a current of 1 ampere in parallel with it. There is a reservoir of mercury shown P, and the lamp is enclosed in a special glass bulb transmitting short-wavelength ultra-violet energy but cutting off dangerous ultra-violet radiation.

This lamp is deservedly called the "sun-lamp." Fig. 16 shows how the energy curve of the sun as shown in Fig. 15 can be realized. The glass bulb acts, as the earth's atmosphere, in eliminating dangerous ultra-violet radiation. The erythemal radiation is, however, increased relative to the visible light so that ultra-violet energy intensities such as occur in natural light can be obtained with light intensities suitable for reading; while with low light intensities the amount of ultra-violet energy obtained is still appreciable. There is also considerable middle ultra-violet radiation as in sunlight, and the short wavelength visible radiation is substantially increased relative to that from a tungsten-filament lamp, yielding a light which is more blue than normal artificial light and more nearly approaching the white of daylight, and which is most pleasant for reading, etc. Approximately 65 per cent. of the light is from the white-hot tungsten and 35 per cent. from the mercury-arc.

The "Mazda" Sun-lamp is fitted into an aluminium oxide reflector, which is highly efficient for reflecting this valuable ultra-violet radiation. The small metal cap actually increases the ultra-violet radiation output, and enables this type of lamp to be made in a convenient size, the power taken by the lamp being approximately 130 watts and by the complete equipment 160 watts. The lamp radiates approximately 0.25 watts of energy in the ultra-violet energy region below 3,130 A., and an ultra-violet energy intensity equal to that in mid-day mid-summer sunlight is obtained at a distance of approximately 30 ins. from the lamp on the axis of the reflector in its equipment with a light intensity of the order of only 200 foot-candles.

The energy below 3,130 A. for the "Mazda" Sun-lamp has almost exactly the same erythemal power as an equal energy in clear strong sunlight, and it has been shown that not only can sunburn occur as in normal sunlight, but also that exposure can definitely cure rickets.

"Sashalite" Photo Flash Bulbs.

Mr. R. LEVENGER (General Electric Co. Ltd.) said that the development of the "Sashalite" Photo Flash Bulb, the operation of which he demonstrated, has rendered flashlight photography one of the easiest of the commercial photographer's problems instead of one of the most difficult. The "Sashalite" bulb is a clear glass bulb of the same shape as an ordinary electric lamp. It contains a small amount of fine aluminium foil in an atmosphere of low-pressure oxygen. The bulb has a small screwed cap, which fits an electric torch in place of the usual small flashlight bulb. By operating the switch of the torch sufficient current passes from the battery to heat the filament around which the foil is located. This causes the foil to burn instantly, and at an intense brilliance for approximately one seventy-fifth of a second, all smoke and residue remaining enclosed within the bulb. Single or multiple numbers of "Sashalite" bulbs may be used as required where large areas are to be photographed. A special pistol-grip fitting has been designed to take an ordinary three-cell torch battery, and for the purpose of testing the bulb before actually firing, a pilot lamp is fitted in the back of the handle. The pilot lamp is in series with the filament of the "Sashalite" bulb, and when the housing is pressed home the lamp should glow, indicating that all is in order.

A flash-bulb clip has been designed enabling several "Sashalite" bulbs to be fired at the same time. The requisite number of additional bulbs are screwed individually into the clips and fixed around the edge of the reflectors. Then on pressing the trigger the bulbs will instantly ignite; no more current than required for a single bulb is used. Only the central bulb is electrically ignited. The remainder being placed in very close proximity to the centre bulb are affected by a particular light radiation peculiar to "Sashalite" bulbs, thereby causing them to fire practically simultaneously with the centre bulb. The device has the advantage that a "Sashalite" bulb in which the filament has been damaged so that it cannot be ignited electrically can nevertheless be utilized entirely satisfactorily in this way, provided that the glass itself has not been cracked or broken.

An amateur outfit has also been put on the market which contains in an attractive case two "Sashalite" bulbs, a special reflector which folds up when not in use, and a Magnet bakelite torch complete with battery.

A New Type of Tubular Lamp.

Mr. H. B. ARNOLD (British Electric Lamps Ltd.) described a type of tubular lamp, suitable for architectural lighting effects, which combined simplicity of erection and maintenance with safety. This "Maxtrip 2" system (See Fig. 18A) is based on the use of special tubular lamps. Mr. Arnold remarked that tubular lamps having a cap at each end (Fig. 18B) have been used in cornices for years; but unless the cornice is some distance from the reflecting medium, shadows from the caps and holders break up the continuity of light reflected. On the other hand, if the cornice is far enough away to avoid these shadows, then much loss of light at the surface of the reflecting medium arises.

FIG. 18A.

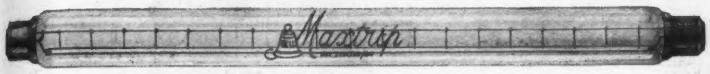


FIG. 18B.

The new system employs lamps having the caps at the side of the bulbs. Absolute continuity of light is thus obtained, and the fitting can be installed quite close to the reflecting surface.

All terminals and connections are mounted in the base of the reflector, which consists of a polished aluminium channel having tubular slots cut in the top, through which the lamp caps pass. (See Fig. 19.)

These caps are indented, and engage, on the under-side of the channel, with two special alloy feeder wires serving the dual purpose of mechanical grip and electrical contact. Although the appropriate Standard Specification specifies a grip of 6 ozs. for ordinary double-ended tubulars, these holders will withstand a grip of over three times this strength.

Moulded bakelite blocks insulate the contacts, and the feeder wires are covered with an insulated sleeve which will stand a temperature of 500° F., and are floating in the channel, where they cannot come into contact with any metal parts. In this way the doubtful, if not dangerous, use of flexible wires inside the channel has been eliminated, insulation breakdowns and burn-outs due to heat or other causes being impossible, as the whole system is now sealed against all atmospheric conditions.

Fig. 20 shows a two-lamp length, complete with optically designed reflector, which should always be used unless the cornice be of such small dimensions that only the lamp and channel mounting can be accommodated. The flexibility of the system is such that should it be necessary to increase the length of the installation at some future date a simple connector is provided for making such extensions *in situ* without the use of any external cable connections.

The depth of the reflector is only $2\frac{1}{8}$ ins., and the width $2\frac{1}{4}$ ins., and they are built from $10\frac{1}{8}$ ins. per lamp length. The lamps are made in 30 and 60 watts, and have a light-intensity of 288 and 640 lumens per foot respectively.

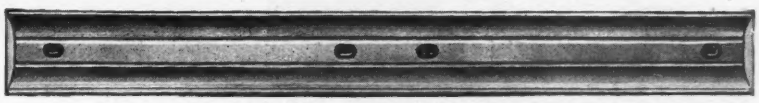


FIG. 19.—Reflector showing slots in the channel.

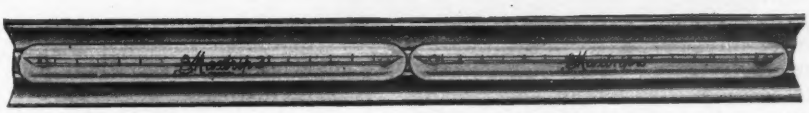


FIG. 20.

STREET-LIGHTING FITTINGS.

Duo-Dome Refractors.

Dr. S. ENGLISH (Holophane Ltd.), as a second exhibit, showed an example of the Duo-Dome Refractors. He explained that this series of dome refractors has been designed to meet the requirements of the closer spacing that is now becoming much more frequent in street lighting than was the case a few years ago. The refractors themselves are of two-piece construction. They are made in three sizes to accommodate respectively up to 200-watt, 300-500-watt and 750-1,000-watt lamps. In each size there are three types of refractors giving symmetrical distribution; directional distribution with main beams at 180° to one another, and directional distribution with main beams at 150° to one another. In the refractors giving beams at 150° to one another there is incorporated on the "house side" of the refractor a reflecting segment which re-directs the light that would normally pass towards the houses across the road, thus filling in the area between the two main beams. This type of refractor is therefore particularly suitable for side-street mounting. In all the directional refractors the beams are given a rather wider spread than has previously been the case, so that even on close spacing the beams spread over the full width of the roadway.

In order to facilitate the correct placing of the filament within the refractors, peepholes are provided on opposite sides, through which it is possible to view the filament through the refractor. An external means of adjusting the position of the filament is incorporated in the lantern. The lantern itself is of robust construction, the hood being made in cast iron with detachable top, and the refractor being vitreous-enamelled steel.

FIG. 21.—Holophane Duo-Dome Street-lighting Unit.

Directional Reflectors for Street Lighting.

Mr. D. A. HART (General Electric Co. Ltd.) illustrated a range of directional street-lighting reflectors of the open reflector form, intended to furnish an asymmetric distribution of light in two, three or four directions, and at angles between the reflectors to suit varying road widths, junctions, intersections and mounting arrangements.

The single-piece silvered-mirror glass reflectors are made of special diffusing glass, which eliminates defined filament images, prevents objectionable glare, and provides a wider distribution than reflectors of similar types, thereby more effectively covering the width of the road; at the same time, by reason of the large area of the reflecting

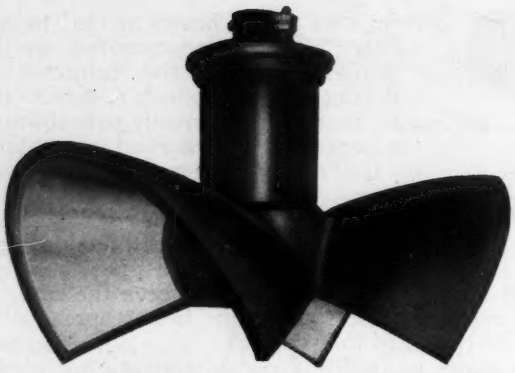


FIG. 22.—G.E.C. Directional Street-lighting Reflector.

surfaces, a high beam-candle-power intensity is maintained.

A feature of the construction is the screw-type focusing device, which is operated by means of an external thumb-nut provided at the top, and serves to bring the lamp into the correct position in relation to the reflectors. The reflectors are designed to produce the maximum beam-candle-power intensity at the useful angle of $77\frac{1}{2}°$ to the lower vertical. The accuracy of the focusing method described is not affected by the size of the lamp, or the normal lamp tolerances.

Two sizes of fittings are available, the smaller range being suitable for 60 to 200-watt size lamps, and the larger for 300 to 500-watt lamps. The angles between the reflectors are indicated on the cast reflector backings, which facilitates correct orientation of the fitting in relation to the street direction.

Open-type "Wembley" Lanterns for Street Lighting.

Mr. HART drew attention to a simple and inexpensive type of open refractor pattern of the familiar "Wembley" lantern recently introduced.

(A) (B)

FIG. 23.—G.E.C. Open-type Wembley Lanterns.

In one form these are constructed with a cast iron top, which supports, by means of a single fixing screw, the spun copper body with combined vitreous-enamelled steel outer reflector and refractor-carrying plate. The special dome-shaped single-piece prismatic glass refractor of symmetric two-way 160° non-axial asymmetric or two-way 180° axial asymmetric type is supported by means of three-way cadmium-plated supports with phosphor-bronze spiral springs. The refractors are of the new low-magnification type, and provide excellent road visibility and road surface appearance. The single-piece construction reduces light-absorption to a minimum. Arrangements are made to ensure correct orientation of the refractor in relation to the street direction.

An important feature of the design is that the separate top, complete with porcelain lampholder, can be screwed to the end of the supporting bracket, wired up, and a good weatherproof joint made, and

FIG. 24. — A G.E.C. Luminous Electric Refuge Bollard of new design.

then afterwards the body with reflector and refractor revolved into the correct position and locked by the single clamping screw. Two sizes are available, the smaller for 60 to 200-watt lamps, and the larger for 300 to 500-watt lamps.

There are also two similar types of open lanterns for 60 to 200-watt lamps, which are of even simpler and cheaper construction. In one pattern the top body reflector and refractor plate are all of cast iron. A similar refractor with locating and supporting means is embodied.

Luminous Electric Bollard for Island Refuges.

A new design of luminous electric refuge bollard or guard-post has been introduced incorporating robustness of construction with high lighting efficiency and easy maintenance

The body is of steel, the upper portion of half cylindrical shape, which is continuous with the underground root. A tier of four vitreous-enamelled white inverted cones are illuminated by the light from a single lamp housed under the cast iron dome-shaped top cover. Additional light is directed on to the cones from a vertical reflector of curved section situated inside the body and behind the cones. These latter are spaced apart, and are supported on two steel rods which run through the length of the body. This provides for easy replacement of the cones if necessary. The single lamp also illuminates the top curved coloured glass panel, which can be lettered "KEEP LEFT" if desired. Ample space is provided for housing switch and fuses in the base, the access to which is obtained by a screw-on type door.

This bollard is extremely effective with the illumination provided by only a single 60 or 100-watt lamp, although provision is made for using a 15-watt pilot lamp, if desired.

"Saaflux" Lighting Units.

Mr. HOWARD LONG (Benjamin Electric Ltd.) made the first public announcement of a new system of industrial lighting known as "Saaflux"—Safe Lighting—which is applied to a familiar range of types of industrial reflectors (i.e., R.L.M., Concentrating, Parabolic Angle, Vertical Elliptical, Elliptical Angle and Distributing).

This system incorporates numerous advantageous features, among which are the following:—

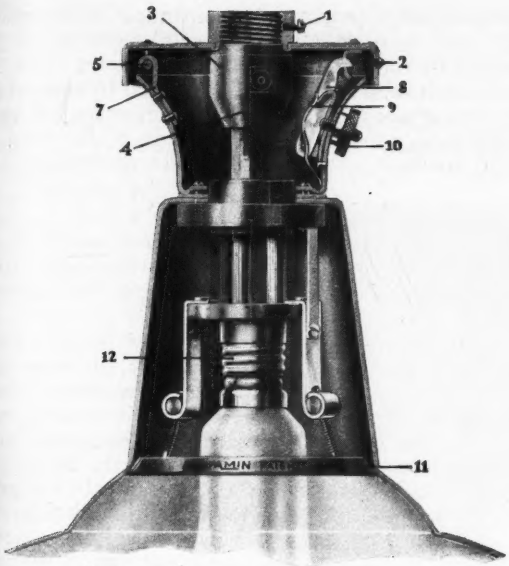


FIG. 25.—Sectional View illustrating nature of "Saaflux" construction.

(1) The temperature of the wires is maintained at the low level specified in the I.E.E. Wiring Regulations. This regulation was formulated to obviate the hardening of the insulation due to heat and consequent short circuits and other troubles arising from this.

(2) The reflector is easily detachable, complete with lamp from its supporting flange, thus enabling both the lamp (which is the more important) and the reflector to be cleaned on the ground.

(3) For wiring it is only necessary to handle the flange with its terminal block, which makes wiring extremely easy and simple.

(4) Every feature and detail in the design has been considered carefully to provide for safety both electrically and mechanically.

(5) In addition to the above major advantages, the construction provides 5 per cent. more light.

In Fig. 25 is shown a sectional view of the "Saaflux" construction.

Mr. Long added that clear glass dust-proof visor screens or partially correcting daylight visor screens could be applied to the R.L.M. and other reflectors in certain sizes, and partially corrected daylight screens could now be attached to the "Glasssteel" Diffuser, as illustrated in Fig. 26.

Mr. Long also exhibited the Specular and Vitreous Floodlights, as shown in Figs. 27 and 28. He drew attention to the small dimensions of these floodlights and the enclosed wiring, and explained that the specular type was intended for mounting close to the surface to be illuminated, whilst the vitreous type was intended for use in cases where the floodlights could be mounted some distance away.

Amongst other new equipment shown at the meeting may be mentioned:—

(1) Local lighting reflectors with partially correcting daylight screens (available in intensive, extensive 45° and horizontal types).

(2) Shock-proof Bakelite Handlamp of robust construction.

(3) Flexible suspension of complete fittings to absorb vibration.

(4) The familiar Benjamin Shop-window Trough, but in a new style of gilt finish.

FIG. 29.—A New Spotlight Lantern.

(5) The "Durban" Lantern, with chromium-plated reflector controlling the light in the same manner as the refractor lantern, but with a definite "cut-off" (based on experiences in the investigation at Leicester in 1930).

(6) Chromium-plated parabolic and ornamental lanterns for use outside shop premises.

(7) Benjamin Cornice Trough Reflector, with white cellulose interior as an alternative to the mirror lining (for use in cases where the cornice is very low, or where cost rather than efficiency is a paramount consideration.)

In conclusion, Mr. Long referred briefly to other new equipment introduced this season, such as the "Bencolite" enclosed diffusing fittings fitted with a new type of ceiling mounting; "Bencolite" spheres and cubes; a new type of "Duoflux" floodlight for pole-clamp mounting; "Miniature Intensolux" fittings equipped with adjustable arms, etc.

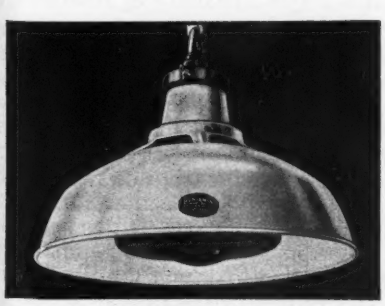


FIG. 26.—"Glassteel Diffuser with Daylight Attachment.

FIG. 27.—Specular Floodlight Fitting.

FIG. 28.—Vitreous Floodlight Fitting.

A New Spot Lantern.

Mr. L. G. Applebee (Strand Electric & Engineering Co. Ltd.) exhibited a new Spot Lantern, in which the colours are changed by means of solenoids, operated from a remote position. These lanterns are designed for use in theatres and cinemas, to be fixed in suitable housings on the front of the circles. The colours are then operated from the stage switchboard, or any other desired position, by means of a small switch. As an illustration of the feasibility of this arrangement, Mr. Applebee mentioned that such lanterns are used at Drury Lane, Covent Garden, and a number of other theatres.

The lantern is illustrated in Fig. 29.

Photometric Equipment, Etc.

A New Precision Visual Photometer.

Mr. J. M. Waldram (G.E.C. Research Laboratories) exhibited a new precision visual photometer, designed to combine high accuracy and reliability with convenience in operation. The scale is

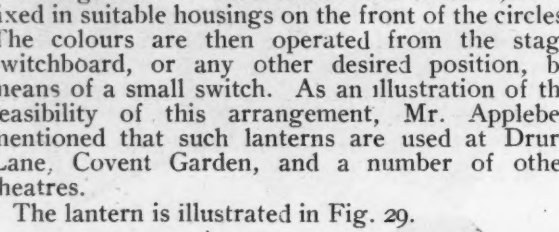


Fig. 30.—Showing constituent parts of Precision Visual Photometer.

accurate within 1 per cent. over its whole length, and a bridge-type control box is used whereby the lamp current can be set to 8 parts in 100,000. A Lummer-Brodhun contrast type field is used, and the comparison lamp is arranged with a colour filter to give a colour match at about the colour temperature of a 200-watt lamp. The principle of operation is similar to that of the old Martens photometer, in which a prism is moved and the lamp is stationary; but it is arranged so that very good screening is obtained. The use of transmitting diffusing surfaces, or silvered glass, is avoided. The interior of the instrument is shown in the photograph. The instrument itself is small, and has no parts which protrude in operation; the knobs for its operation are large and conveniently arranged, so that the photometer can be easily operated while wearing thick glass. The scale is illuminated, and is placed alongside the eyepiece so that it can be conveniently read; the number of the neutral filter in use appears beside the index of the scale. The total range is from 0.001 to 12,000 foot-candles.

The performance of an illuminometer is dependent upon its proper and regular cleaning, and the instrument is therefore so arranged that it can be very easily dismantled and reassembled and all important glass surfaces cleaned, without disturbing its adjustment or calibration and without the use of tools. Provision is made for the use of special colour filters when coloured sources are being measured.

The control box is separate from the battery box, but can be attached to it to form one unit carried by a single handle. The galvanometer key is arranged at the side of the box adjacent to the knob of the main resistance (which is a continuous wire resistance with self-cleaning contacts), so as to be operated by one hand. The galvanometer is on the top of the box, and can be illuminated by a separate lamp and dry battery. A set of accessories has been designed to enable the instrument to be used in special positions or clamped to other instruments.

The Study of Air-Currents.

Mr. J. M. Waldram also demonstrated an improved form of Schlieren apparatus, adapted for the study of convection air-currents around lighting fittings.

The apparatus, which is illustrated in the photograph, is used with a mirror of 12 ins. diameter and 10 ft. radius, and a projection system was used which enabled the convection currents to be seen upon a screen by the whole audience. The hot air arising from the hand, etc., could be clearly seen. A demonstration was given of the effects of anti-convection discs upon the heating of lampholders.

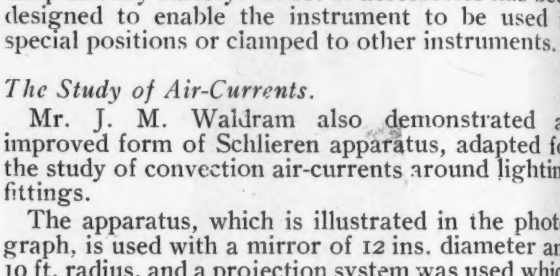


Fig. 31.—Showing essentials of improved Schlieren Apparatus.

A description of the apparatus will appear shortly in the *Journal of Scientific Instruments*, but the principle of operation is, briefly, as follows: A fine, straight edge is erected at the centre of curvature of an accurate spherical mirror, and a beam of light from an illuminating system is directed past it on to the mirror. After reflection at the mirror it is again brought to a focus at the straight edge, which is arranged to cut off most of the returning light; such as passes the edge is deflected by a prism to a system of projecting lenses, by which an image of the mirror is formed on a screen. If any optical inhomogeneity occurs in the path of light between the mirror and the straight edge, the returning light is deflected, and either strikes the straight edge and is cut off, or misses it by more margin than usual. The corresponding parts of the image therefore appear upon the screen as darker or lighter than the general foreground.

A Semi-Automatic Light-Distribution Photometer.

Mr. G. H. Wilson (G.E.C. Research Laboratories) demonstrated a semi-automatic light-distribution photometer. The apparatus was developed primarily for the purpose of obtaining polar curves of lamps and lighting units in such a manner that the method of production should be obvious. It has since been used successfully for laboratory purposes. A photo-electric cell is fixed to an arm which rotates round the fitting under test. Connections are made from the cell to a mirror galvanometer placed behind a transparent disc to which the polar-curve paper is attached. As the cell is rotated round the unit the polar-curve paper rotates at the same angular speed, and if the galvanometer spot is

followed by a pencil on the paper it will trace out the polar curve of light-distribution.

A Portable "Lumen-Cube" Photometer.

Mr. J. McMANUS (Everett Edgcumbe & Co. Ltd.) explained the use of the Portable "Lumen-Cube" Photometer illustrated in Fig. 32. He explained how, by the aid of a photo-electric cell within the cube, a direct reading of the output of light in lumens of the lamp under test is obtained, and how, if desired, simultaneous measurements of the wattage can be obtained. The apparatus is quite compact, the cube being only 12 inches square, and can be carried by means of a handle attached to the roof of the cube. The standing range is 0 to 1,500 lumens, but other ranges can be furnished if desired.

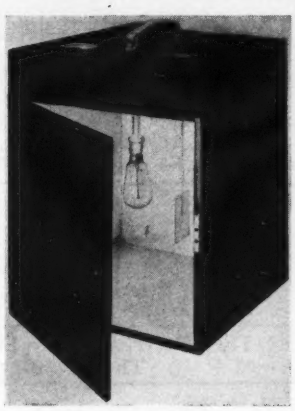


FIG. 32.—The Portable Lumen Cube Photometer.

A New Direct-reading Photometer.

Mr. C. W. LESLIE (Stafford & Leslie) exhibited a new form of direct-reading illuminating photometer of compact dimensions. Both the "Tavolux" and "Amalux" types depend on the use of a photo-electric element which, when exposed to light, yields a current sufficient to give a direct reading on the scale of a sensitive recording instrument. In the "Amalux" apparatus the photo-element is built into the lid of the recording instrument; in the "Tavolux" type the photo-element is plugged to the latter, and in this type of photometer double scales reading up to 10 and 100 foot-candles respectively are now provided.

ILLUMINATED SIGNS, ETC.

The final section of the exhibits comprised several ingenious forms of illuminated signs, etc.

The "Sinterae" Vibratory Lighting Unit.

This apparatus, in the absence of Mr. L. G. TOPLIS, was exhibited by Mr. ELDRIDGE. It makes use of two similar electric lamps, the light from which is interrupted by means of a motor-driven shutter. When the positions of the two apertures, and the angles from which the light is received, are skilfully adjusted curious effects of animation can be produced, especially when the object illuminated exhibits projections or highly polished facets. The effect is particularly striking when applied to lettering which projects somewhat from its background and is caused to appear in a constant state of motion. An allied but less pronounced effect is secured when irregular polished objects, such as metalwork and jewellery, are illuminated by the vibratory light. Such objects have a constantly changing and sparkling appearance, which becomes specially vivid when coloured light is used. The degrees of animation can be varied within wide limits by altering the frequency and intensity of the vibration from a scarcely discernible "ripple" to a striking oscillatory effect. In general, it is expedient to keep the apparatus, so far as possible, screened from view, so that the looker-on sees only the objects subjected to the intermittent light.

(*Continued on Page 292.*)

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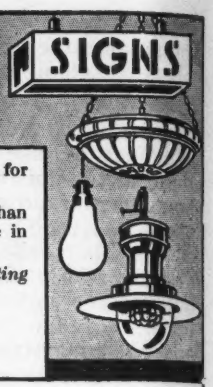

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Siemens Sieray Lamps

A CORRECTION.

Our attention has been drawn to a clerical oversight which appeared in the advertisement of Messrs. Siemens Electric Lamps & Supplies, Ltd., on page X in our last (October) issue. The figures under the view of the lamp on the left-hand side of the advertisement suggested that the Siemens Sieray lamp, which consumes approximately 400 watts, furnishes only 1,600 lumens. Naturally this figure should have been *16,000 lumens*, for this new lamp yields approximately 40 lumens per watt initial efficiency.

The "Day-Vista" Machine.

This apparatus, which was shown by Mr. PAUL GREENBERG, enables the images of articles to be projected towards the observer, so as to be apparently floating in mid-air. If the device is installed in a shop-window, for instance, it is possible to cause the illuminated object to appear on the far side of the window-glass. The device consists in a combination of mirrors and lenses and a box with whitened interior, in which two electric lamps are mounted and in which small objects such as packets of cigarettes, small models of furniture, etc., can be placed. Sales messages can likewise be projected to appear amidst the goods in a shop-window.

Illuminated Direction Signs

We are informed that, at the forthcoming Public Works, Roads and Transport exhibition the exhibits of Messrs. Gowshall Ltd., who make a speciality of illuminated direction signs, refuges, etc., will be particularly comprehensive. At Stand No. 10, in the Entrance Hall, the latest M.O.T. illuminated signs, the "Selflite" range of signs, and the "Guardian Angel" illuminated guard post, will be on view. The large No. 138 Stand, in the Gilbey Hall, will show a great variety of illuminated signs and guard posts carried on steel tubes of the tube made by the Bromford Tube Co. Ltd. Complete safety islands and road markers, executed both in studs and in continuous lines of stainless steel, will also be seen.

Seasonal Catalogues

We have to acknowledge, amongst others, attractive seasonal catalogues from the British Thomson-Houston Co. Ltd., the Edison Swan Electric Co. Ltd., Philips Lamps Ltd., and Siemens Electric Lamps and Supplies Ltd., to which we hope to devote more attention in our next number.

We have also to mention receipt of a list of "Linolite" Strip Reflectors, and take the opportunity of drawing attention to the change of name to Linolite Ltd. (formerly A. W. Beuttell Ltd.).

The New G.E.C. Illumination Showrooms

A visit of the press was paid to the reorganized lighting showrooms of the General Electric Co. Ltd., at Magnet House, Kingsway, on October 13th. A feature of this extensive display is the contrast afforded between conventional fittings and those of the more modern and "architectural" types. Some delightful examples of concealed lighting, which offers a new field for design, were to be seen. We mean to refer more fully to this display and to show some very pleasing illustrations of these effects in our next issue.

Siemens Electric Lamps and Supplies Ltd.

CHANGE OF TELEPHONE NUMBER.

We are asked to mention that from October 14th onwards the telephone number of Messrs. Siemens Electric Lamps and Supplies Ltd., at 38-39, Upper Thames Street, became Central 2332 (10 lines).

Contracts Closed

The following contracts have been announced:—

EDISON SWAN ELECTRIC CO. LTD.:—

Nottingham Education Committee; for the supply of lamps for the period ending March 31st, 1934.

GENERAL ELECTRIC CO. LTD.:—

Carmarthen County Council (*Public Assistance Committee*) and *County Borough of Burnley* (*Public Assistance Committee*); for six months' supplies of Osram Lamps.

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